

AVIATION WEEK

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FEB. 15, 1954

50 CENTS

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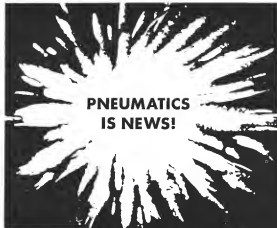
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Domestic

Boeing B-72 has an action sales of \$800 m, but USAF wants an increase to \$500 m and "will get it," Air Force Secretary Harold R. Telford forecasts.

F47 production at Packard Motor Co. is 13 million in 10 years at Dearborn, Mich., will be opened to one third of the factory's floor space this year to make room for manufacture of proposed V-8 automobile engines, automatic transmissions and axles.

Defense Department has set up a technical advisory panel on aeronautics to develop recommendations for air lenses, propulsion systems, aerodynamics, equipment and components of piloted aircraft and guided missiles. Chairman of the civilian panel is Dr. C. G. Farnes, director of Cornell Aeronautical Laboratory, Buffalo, N. Y.

Flight safety could be increased by extensive use of aircraft simulators in emergency training, suggests Rose Adia Jans de Ploiere (USNR), who developed Navy's simulator training device. Life size simulators would train pilots to act instantly as an emergency, giving those "low pressure periods that could mean the difference between life and death."

Boeing-Pack Motor Co. has taken over USAF's \$80,000 to \$1.5 million program for aircraft and engine testing, (General Plant 175), Adams, Mich. Air Force work will continue to have priority, but Boeing-Pack also expects to do some contractor work at the facility.

Aircraft weldwork at General's Precision Welding Co. will increase 10% with increase of five cents in hourly plus other benefits under a new labor contract signed with International Association of Machinists (IAM).

Boeing Airplane Co. has produced its 50th C-97 Stratofreighters. Production began in 1944. Since August 1955, the tanker transports have rolled off assembly lines at a rate of one for each working day.

Walter Sandoz, former assistant chief director of the Senate Small Business Committee, has been appointed director by a unanimous vote of members. He succeeds Lawrence Henderson, who resigned to enter private business.

Josephine Cochran lost work because the first version to receive the annual Frank B. Rowland Award, presented by



Turboprop C-124 Makes First Flight

Developed by Gen. PMA T34 turboprop engines of approximately 3,700 shp, such a Douglas DC-124 (Glasgow) is one of the first test in its class to be flown from the company's Long Beach, Calif., plant in Edwards AFB. The first U. S. four-engine turboprop to fly, the DC-124 made a stop in the development of a new turboprop-powered Douglas turboprop transport for the Air Force, the C-119. It is a new USAF and Navy turboprop program, under which several other aircraft transports, including the Lockheed C-130 Super Constellation and Boeing C-97—will be powered by T34. The Glasgows normally is powered by PMA B-500s.

The American Legion's Air Service Post 931 in New York for "outstanding service" to women in 1955.

Financial

McDonald Aircraft Corp. in Los Angeles had net profits totaling \$2,633,120 in the first half of April 1956, compared with \$1,811,425 for the same period of 1955. Sales totaled \$8,302,387 to \$66,715,018, but the company forecasts a drop during the second half. Bookings as of Dec. 31: \$55,366,113, highest in history.

Northwest Orient Airlines net income dropped \$81,000 during 1955 to \$1,684,806, according to preliminary unaudited figures. Net revenues from operations were \$3,277,336, nearly doubling 1954's \$697,590. But net profit from sales of aircraft and parts totaled \$167,542, compared with \$1,137,377 the previous year.

Capital Airlines had net earnings of \$1,672,289 for last year, compared with \$1,412,645 in 1954. Operating revenues increased 12.8% to \$45,550,523, highest in the company's history.

North American Aviation, Los Angeles, reports net income totaled \$180,800 to \$2,750,000 during the last quarter of 1955. Despite a 5.4% decline, PMA's unaudited figures show sales and income totaled \$131,167,560. Bookings on Dec. 31: \$1,011,745,707, compared with \$958 million at the end of the previous year's first quarter.

Carson-Wright Corp., Wood Ridge, N. J., has delivered a dividend of \$2.80 per share on Class A stock, payable in four quarterly installments of 70 cents on Mar. 22, June 23, Sept. 25 and Dec. 23. Common stock dividend at 35 cents, payable Mar. 23 to holders of record Mar. 3.

United Air Lines will pay a regular 25-cent quarterly common stock dividend May 15 to holders of record Feb. 15.

International

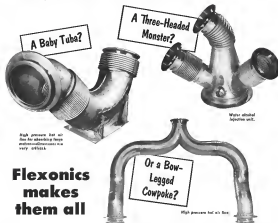
Radioelectric TV equipment developed by Fv, Ltd., of Cambridge, is being used by British Overseas Airways Corp. in its search for wreckage of a C-47 that crashed 100 miles inland into the Tiberian Sea 10 mi. off the island of Saba Jan 10 (Associated Press Jan. 15, p. 16).

Air France has signed contracts for purchase of three de Havilland Comet 4s, doubling its order for that type jet transport. The French airline began operating Korea Line jet aircraft, expects to take delivery on first Comet 4 early next year. Air France last week celebrated its 35th year as an airline (see p. 16).

An agreement has been signed by Scandinavian Airlines System with Russian Air Union Aviation, allowing SAS to sell air travel tickets to Communist China via Moscow and increasing air-tickets. Stockholm-Moscow flights from there to go a week.

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WHO'S WHERE

In the Front Office

K. J. Schenck, president of Coddens Eastern Aircraft and one of the founders of Northeast Airlines, has been elected board chairman of Lind Air, Inc., Chicago. New York, Ralph J. Arnold (USAF), commanding officer of Aviation Supply Depot in Philadelphia, will become vice chief of the Office of Naval Material in Washington, D. C. and shortly thereafter will be named in Philadelphia by John A. Ford with L. H. Hester (USAF), assistant chief of the Bureau of Supply and Accounts, Washington, D. C.

C. J. Higgins, former public relations manager for An Aircraft, is now president of Bell Aircraft Corp., Norwalk, N. J. Ford Galtchuk, who formerly was Air Force, has joined Bell as vice president.

William B. Tarr, Jr., has been elected president of Bell Aircraft Corp., Norwalk, N. J. Other new officers: James G. Kelly, vice president; John Milne, Jr., secretary; and Steven Phillips, treasurer.

Charles A. Sereno has been promoted to vice president and general sales manager of Air America's Aircraft and Mechanical Products Division, Torrington, N. J.

Harold L. Hubbard, vice president-engineering of Lockheed Aircraft Corp., has been elected to directorship of the company's three aircraft service subsidiaries. Henry H. Ogden is now vice president and plant manager for Lockheed Aircraft Service at Burbank, Calif.

John J. Galtchuk has become vice president of Lockheed Aircraft Corp., Burbank, Calif. John J. Galtchuk has been appointed vice president of A. E. Galtchuk & Associates, design and engineering in New York, N. Y. Galtchuk has been elected a director of Northeast Aircraft to represent Edman Manufacturing Co., one of the largest stockholders of the Burbank, Calif. aircraft builder.

Honors and Elections

Charles E. Beatty, director of Civil Control Aircraft Co. a Tappanville Division, has won the American Rocket Society's Charles Nicholas (Hudson) Award.

Lee B. Johnson, chief safety engineer for Northeast Aircraft, has been elected a vice president of Veterans of Society.

Changes

H. C. Pittman has been elected assistant secretary treasurer and Paul F. Mincey, vice president of Republic Aviation Corp., Farmingdale, N. Y.

Clarence Walker is now assistant general manager of Bell Aircraft Engine Co., Farmingdale, N. Y.

James E. Glasser has been appointed chief engineer of Pacific Scientific Co.'s Aircraft Division, Los Angeles, Calif.

George D. Newman, Jr., has been named general manager of Heliway West Inc., Alhambra, N. Y.

(Continued on page 64)

INDUSTRY OBSERVER

First production model of the Cessna F-103 is scheduled to roll out of the San Diego factory early in March. Meanwhile, second prototype F-103 has taken its first flight at Edwards AFB.

North American Aviation's test vehicle for its Navaho missile has made its last flight at Edwards AFB. Designation is believed to be N-18.

Curtis-Wright Corp. is negotiating for use of the Navy's 540,000 sq ft engine plant during completion at Astoria, Mich., for production of its J63 turbojet. The Navy factory originally was planned for second-line production of the Westinghouse J40 turbojet by the Lincoln Mercury Division of the Ford Motor Co. The J40 now is almost completely out of the Navy engine program. The Wright J67 is progressing for such strength in advanced versions of the F-103 and the F-105, and USAF is reluctant to put the engine into a facility with Navy equipment. USAF is pushing Wright to use a Chicago plant under USAF supervision.

Top-level Pratt & Whitney officials are considering a Navy proposal that virtually would eliminate Westinghouse from any future part in jet engine development. Meanwhile, Westinghouse is attempting to convince the Navy in a new jet engine development program.

Airframe manufacturers tied to the Wright J65 turbojet program are getting increasingly uneasy over the production situation on this engine and its passage USAF for some positive action.

National Advisory Committee for Aeronautics will hold a technical conference on helicopter research problems late this year at its Langley (Va.) Laboratory. Attendance will be limited to persons with security clearance appropriate to the information to be discussed.

Military security restrictions may delay Sikorsky's all-out commercial sales campaign on the two-engine, 35-passenger S-55 helicopter about six months. Progress is concerned at the rapidly with which the Russians copied the Sikorsky S-51 and S-55 designs after their first general appearance and release of test data.

Curtis-Wright Corp. has a contract to develop a flight simulator for the Boeing B-52 Stratofortress jet bomber. Strategic Air Command, scheduled to operate the B-52, is the largest user of flight simulators in the world.

Engineers are checking over the new engine shows from Bell Aviation, N. Y., against USAF Secretary Harold Talbot in describing the B-52 turboprop engines "with effectiveness, based on" Models of the Pratt & Whitney J57 used in the B-52 do not have effectiveness.

Thomas A. Edison, Inc., has received a contract to supply five turbine systems for the Curtiss F-102 all-weather interceptor. This is one of the first production applications of the Edison turbine system.

All (non-Bell) Vought jet bombers-Vulcan, Victor and Valiant-will have their internal 5,000-hp range extended in addition of Flight Refueling, Ltd., aerial refueling equipment.

English Electric Canberra bomber production is scheduled to phase out by 1956 with the exception of a new delivery of the 4,000-hp class. The Vulcan "900" design is not yet firm, but it is known that British European Airways, interested in the project, wants a high-wing configuration.

Victor has a new transport design on the drawing board known as the "V-101." It is based on the new Bell Boeing turboprop in the 4,000-hp class. The Victor "900" design is not yet firm, but it is known that British European Airways, interested in the project, wants a high-wing configuration.

Bell Aircraft Corp. XH-39F is a gas turbine-powered version of the Model 47 four-place helicopter. XH-39F uses a Turbomeca Astromec delivering 250 hp.



IL-28 Il-28, twin-engine bomber with four turbo-prop engines, in a squadron service with Red air units in northern provinces of USSR.

Airpower Behind the Iron Curtain:

Pictures Reveal Reds' New 'Sunday Punch'

By David A. Anderson

First photographs of Russia's two new turbo-prop bombers confirm the rapid buildup of offensive airpower within the Soviet Union.

These exclusive Aviation Week pictures show service models of the latest Red intercontinental weapons.

- **Bombardier 35**, a four-turboprop, swept-back heavy bomber comparing in size to the Boeing B-52.
- **Tupolev 28B**, a six-turboprop, swept-back heavy bomber in size and weight class with the Canadair B-36, now out.

More than 400 of these aircraft now are reported to be based in the northern provinces of the USSR across the Polar

Icecap from the North American continent. First reports of squadron strength in that area appeared in *Aviation Week* (Sept. 28, 1953, p. 57).

Recognizable versions have made routine observation flights at various altitudes above the Alaska and Chukotka defense perimeter.



TUPOLEV 28B, a six-turboprop bomber also in squadron service with Russian air units, has atomic capability and intercontinental range.

These two advanced turbo-prop designs are backed up by a fleet of about 700 aging but operational Tu-4s, Tupolev's adaptation of the Boeing B-29.

► **Irishish Design**—The quality of the two bombers is credited to Sergei Irishish, designer of the B-28 series of light bombers, the B-11 two-engine transport and the B-18 four-engine transport.

Irishish's big bomber is powered by four turbo-prop engines rated at 4,500 hp each. Maximum speed is 450 mph, service ceiling is in the neighborhood of 50,000 ft. Range, approximately 5,000 mi without aerial refueling.

Wingspan of the B-35 is 168 ft and overall length 172 ft. An eight-engine crew is reported.

Designation of B-35 now is believed correct, originally the bomber was called the Type 31 and, later, the B-31.

► **Tupolev Bomber—And**—Tupolev long identified with bomber attack designs in Russia, and designer of Russia's B-28, at the design of the biggest Red aircraft so far.

With a span of 256 ft, and an overall length of about 200 ft, the Tu-28 can be compared directly only with the Canadair B-36.

Maximum speed is reported to be about 400 mph, and service ceiling is 50,000 ft.

Range of the Tu-28 is about 4,500 mi, again without aerial refueling.

Originally designated Tu-27, and believed to be a collaboration of Tupolev with Mikhail Gurevich, an designer of the MIG-15, the six-engine bomber now is credited to Tupolev alone, and designated Tu-28.

► **Focus of Difference**—Easiest way to tell the B-35 and the Tu-28 apart is to count the engines. Otherwise, the planes appear similar.

But there are detail differences in the design. Russian swept-back wings overtopped, a right rudder and a high-mounted horizontal tail without dorsal fin. Wings are each segment, dropped outer side of the engine nacelles.

Tupolev's bomber has only small sweptback, and considerable wing and tail dihedral.

Bomber and those are commonest air force, not apparent.

► **B-29 System**—The photographs reveal Red philosophy on bomber defense differs from current U.S. thinking.

Russian aircraft engineers appear to be still under the spell of the B-29 remote-control system used in World War II.

Despite the obvious drag disadvantages, the Russians retain a special coverage system with several non-retrievable aircraft. This contrasts to U.S. practice, which is to rely on speed and defend the tail only. Even the B-36,

last of the U.S. bombers with upturned coverage, was vulnerable to attack by the current Red air force.

The four engine bombers on the Tu-28 are positioned much like those on B-28s and Russian Tu-4s. From their size, they are supposed to mount paired 20-mm cannons.

► **Valuable Note**—The small colored appendages at the tail suggest the tail fin may be retractable, like the B-36 and B-47 aircraft. But there appears to be a general desire forward.

Air Buying In for Hard Bargaining

USAF, Navy's BuAer plan to obligate \$5.7 billion before next July on aircraft and related equipment.

By Robert Ryan

The aircraft industry, not long faced with a heavy schedule of back-fitted contract negotiating during the last half of fiscal 1954 after a virtual lull in new military orders since last July.

Both Air Force and Navy are going to their annual procurement talks to grant new contracts as an coordinated sale between new and next July.

Both services plan to order about \$5.7 billion in aircraft and related procurement before the end of fiscal 1954 on June 30.

Navy plan to obligate all but a small portion of its \$1.5 billion available on Jan. 1 in unobligated aircraft funds.

USAF plan to obligate about \$4.2 billion during the last half of fiscal 1954 and carry over 1955 over July with about \$1.5 billion in unobligated funds for aircraft and related equipment.

► **Obligation**—USAF and Navy's Bureau of Aeronautics have obligated only \$319 million for aircraft procurement during the first six months of fiscal 1954. This contrasts with obligation of \$9.1 billion made during the same period of fiscal 1953.

Both services carried a balance of \$5.7 billion in unobligated aircraft procurement funds on Jan. 1, compared with \$6.7 billion on Jan. 1, 1953.

During the first six months of fiscal 1954, USAF and Navy paid net \$4.2 billion on previously obligated letters of intent and contracts for aircraft and related equipment. USAF contract got \$3.5 billion, while BuAer supplies got \$1.2 billion.

On Jan. 1 USAF and BuAer had a suspended balance of \$2.7 billion in aircraft procurement money, of which \$1.4 billion was for USAF and \$7.6 billion for BuAer.

► **Shakedown**—Fleet—Aviation Week's interview with top military procurement officials indicated the following factors causing both services to slow obligation of fiscal 1954 procurement funds.

- **Shift from letters of intent to firm contracts**—The shift from letters of intent to firm contracts has had the most significant effect in postponing high volume of aircraft procurement.

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needed helicopters from the first to the last half of the fiscal year.

Initially, both USAF and Navy encountered a three to four-month delay in getting their fiscal 1954 procurement program under way because of the disagreements of the new Republic civilian team in the Pentagon.

However, once the fiscal 1954 program was reauthorized in the fall of 1953, the traditional flow of helicopter lettings of contract failed to materialize.

► **Stronger Position—Navy** airborne, cruise and engagement manufacturers were informed of their part in the projected program late in 1953 and, with few exceptions, were requested to return to government officials when they were ready to negotiate final contracts of either the fixed-price or a cost-plus type.

USAF currently is negotiating the first fixed-price contract with a major aircraft producer since the outbreak of the Korean war.

This type of negotiation puts both parties in stronger bargaining positions and, inevitably, results in a negotiated, bankrolled bugging over specific points in the contract. It generally is considered a more efficient method of doing business by both the military and aircraft manufacturers. This means government funds are not carried in the military books as obligated until actual firm contracts are negotiated.

► **Funds Reverted—In the meantime,** funds involved in contracts and letters of intent awarded in replacement of USAF and Navy procurement programs have reverted to the mobilization account.

There will not show up as obligations until firm contracts are negotiated by new component such as the F-100 and B-52 production orders that

are being negotiated out of funds from canceled contracts.

Technical conversations on production contracts will continue to be a trend in the Pentagon. Both USAF and Navy recently tendered during the Korean crisis in production programs for technical developments that never approached their projected performance.

Now the services are working for actual test data on prototypes before committing funds for heavy production programs.

One example of this is the Convair F-102 supersonic all-weather interceptor. USAF has a large production program scheduled for the F-102 in the likelihood of its future as defense system that both of the funds for large scale production will not be committed until flight test data on the prototype show flying shows performance will match engineering predictions.

► **Shorter Lead Time—Each USAF** contractor has furnished Air Material Command and the Pentagon with its own estimates of shorter lead times required for items already in production.

USAF plans to schedule its orders close to their lead times, and in most cases this permits a shorter lead time and short orders into later fiscal years. Short on a long-term basis, and multiple short orders also delay the rate orders become necessary to keep production lines going.

CAA Plans Exposure Of DME Coverage

Defense let back in Civil Aeronautics Administration to complete re-statement the view of 317 civil aircraft increasing equipment status has resulted differences between civil and

military DME programs (AVIATION WEEK May 12, 1953, p. 48).

Defense Department sources said that the differences will be being argued before the Air Navigation Development Board, and that the civil system data will meet the military's technical requirements.

► **Interim Phase—Observers** see the CAA decision as an interim phase in the development of a common system of air navigation and traffic control for civil and military use. They also see that the military's Texas (tactical aerial navigation) system is concentrating the available technical problems of new complex equipment and that the civil DME will have adequately shown the year it will take to perfect, produce and install Texas.

It also is pointed out that civil DME would lose by default action a definite public view is taken by CAA. The makeup of the common system has been the subject of better disputes in ANDO.

► **Clear the Air—A CAA spokesman** stated:

"We felt it was necessary to align the form of communications and the form public that there were plans to scrap the present civil DME system. It was purely a CAA decision. We wanted to give the air to show that we are going along with previous plans." He admitted that CAA had been under pressure to state positively that civil DME would not be abandoned for the military Texas system.

"In order to meet the needs of aviation which have grown over faster than originally anticipated," Fred B. Lee, CAA Administrator, said, "we are considering the installation of the VOR, DME, which are the basic elements of the common system approved in 1949 by military and civil aviation interests through the Radio Technical Commission for Aeronautics. This is known as the 'common system.' This is the program endorsed by Congress and for which funds have been appropriated."

► **122 in Operation—VOR and DME,** Lee continued, "are fully developed devices, which were adopted as the result of many years of research, testing and experience. Plans have been made since then are well situated with the results that have been getting in terms of civil aircraft and speed navigation, others have been developing themselves even due to the advantage of VOR and DME."

CAA states that the 317 DMEs are now on the air in addition to 122 DMEs already in operation. Total cost of the DMEs is \$3,888,000.

Results recently reported indicate acquisition to \$28,000 for the airborne DME sets, and National Aeronautics Corp. (NACA) has a comparable book.



CONVIER F-102 FIGHTER, shown in left wing, stands upright outside plant at San Diego in setting wide wingtip slanting plane to about 80 ft. Height is estimated at 30 ft. By counterbalancing Aerodynamic force on the F-102 by the wingtip, the plane was supported with a crane lifted by a helicopter from a public and adjacent to the Convair factory. Pilot sits in a writing cockpit.

New Details on VTO Projects

Navy's vertical takeoff fighter projects (AVIATION WEEK Jan. 25, p. 16) have now been set forth with the publication of an Associated Press wirephoto of the Convair F-101.

The AP photo was taken with a telephoto lens from a public highway that shows Convair's San Diego plant. The F-101 had been rolled out of the factory on completion and was in full view from the highway, although some of its details were obscured by surrounding wood shed.

► **Classified Secret—The AP photo** apparently was taken after photographers from a national weekly magazine had been admitted to the Convair plant to photograph the F-101 in full color. Other photographers were heard by the Navy on the grounds of military security.

The F-101 was classified "secret" by the Navy at the time the magazine photo was taken.

The color photographs generated by the Navy were scheduled to illustrate an article by a top Navy official in the national magazine. Navy's plans to permit the release of the F-101 color photographs in this magazine article were approved by Assistant Defense Secretary Fred A. Sorenson on the grounds of military security. Sorenson also said he was approved by the military sources granting exclusive stories to individual publications on new weapons.

► **XP-101 Incident—The F-101** incident was the second time in recent years that Navy attempts to conceal a Convair aircraft after rollout have been foiled by

photographers operating from the public highway.

When Convair several years ago rolled out its XP-101, giant turbojet-powered flying boat, Navy barred external photographers although it was in clear view from the heavily traveled public highway adjacent to the plant. The first published photograph of the XP-101 was taken from the highway, despite Navy's security precautions.

The Convair project is part of the Navy's VTO program aimed at development of interceptors that can take off and climb vertically, fly and maneuver at current jet fighter speeds and land vertically within a small area (AVIATION WEEK May 12, 1953, p. 15).

► **More Power—In addition to the Convair F-101,** Lockheed has completed a VTO prototype. Both the Convair and Lockheed VTOs are powered by an Allison T-30 turbojet rated at 5,500 hp and develop a pair of Aerobee-like ram-jets during propulsion. Both VTOs now require 1000 hp for takeoff.

However, Allison is developing a 7,000-hp advanced version of the T-30, designated T-38, that may provide sufficient power for vertical takeoff with out turbo.

The Convair and Lockheed VTOs have long, slim fuselages with the conventional propellers positioned at the top, similar to a helicopter rotor. The fuselage is mated on four rail for takeoff and landing. Pilot is enclosed in a cockpit that rotates on a gimbals mounting with the attitude of the fuselage.

► **NACA Research—USAF, British Navy** and the Russian air force also are working on lighter aircraft with vertical-takeoff and landing characteristics. Last month the National Advisory Committee for Aeronautics revealed it was doing basic research on stability and control problems encountered during the vertical period during conversions from vertical to horizontal flight (AVIATION WEEK May 12, 1953, p. 16).

At that time, NACA noted "great development of turbojet and turbojet engines, which have a high power-to-weight ratio has quickened interest in the possibilities of designing aircraft which will permit both the vertical and high speed of conventional aircraft."

USAF is taking a different approach to the VTO problem, than the Navy. It is concentrating on development of bypass type turbojet engines with a high percentage of bypass air to power its VTO projects. Engine calculations indicate a jet producing about 20,000 lb. of thrust could provide vertical lift for a fighter grossing about 15,000 lb.

► **Advantages—USAF's interest in the VTO fighter is based on its use both as**



First View of Beech 'Super 18'

Here is first picture of 1954 Beech E18S civilian transport, recently delivered to the company's dealer at Wichita (AVIATION WEEK Feb. 1, p. 18). Some of the new design innovations incorporated in the "Super 18," as the company calls it, are

reversible control surfaces with opened top modified control windshield and four extra windows with greater glazing, as plane of three windows in either model. Fuselage also is deeper. First delivery of the new E18S, now expected this summer, costs \$99,900.

a highly mobile interceptor and a turbo of support aircraft.

VTO squadrons could be operated from unimproved natural landing fields as grass, rice or ploughed fields and serviced by mobile trailer units.

Navy's interest in the VTO fighter is primarily for shipboard use, reducing carrier, missile cruiser and submarine. **►Revised** Capgem—Early opposition to the VTO problem was made by Focke-Wulf in Germany and General Electric Co. in this country. Both the company-owned Focke-Wulf design of 1946 and the General Electric proposal of 1946 were involved in competition with retropropeller configurations.

General Wright also built the prototype XJ2F as a two-engine, side-by-side aimed at approaching vertical-lift characteristics combined with hovering characteristics for slow and short landings.

►Problems—In addition to the basic problem of providing an adequate weight/power ratio, some of the peculiar problems of VTO include:

- **Control at low speeds.** At low landing speed of about 100 mph, control surfaces have no authority in which to take hold and consequently are ineffective. Indicators are used such as reduced descent, such as the carburetor jets in the XJ2F, to assist in control.

- **Statically controlled flight.** Early attempts to design an airplane that would be effective in the widely varied aircraft attitudes of a VTO fighter were unsuccessful.

- **Ground handling.** Since most VTO designs have the landing gear on the line, there will be quite a problem in moving around a carrier deck or shifting from mobile ground carriers to actual ground handling.

- **Stability and control during conversion from vertical to horizontal flight.**

Air Force Reshuffles Six Top Commanders

Reshuffle of top USAF officers last week brought new assignments for six of the most important positions in the Air Force. (AVIATION WEEK Feb. 5, p. 12)

Changes include:

- **LTJ Gen. Earl E. Ramage,** now deputy chief of air staff for operations, is nominated for promotion to full general and will replace LTJ Gen. Otto P. Weyand as commander of the First Air Force.

- **Major General William G. Smith,** now commander of the 31st Air Command, will replace Major General...

- **LTJ Gen. Gerald B. Cook,** also selected for promotion to full general, will replace deputy chief of the air staff for...

material, will become deputy command-in-chief of the U.S. European Command. He will also serve as Air Force officer in charge of command U.S. forces in Europe under Gen. Alfred M. Gruenther.

- **LTJ Gen. Edwin W. Rusk,** now deputy chief of air staff for operations, is nominated for promotion to full general and will replace Major General...

- **LTJ Gen. Frank P. Forester,** now director of the joint staff of the Joint Chiefs of Staff, replaces Gen. Pennington.

- **LTJ Gen. Royce E. Rusk,** now USAF inspector general, will replace Gen. Cook.

- **Major Gen. Truman H. London,** now deputy chief of air staff for operations, replaces Gen. Rusk and has been assigned to the Inspectant General.

Reported resignation of Gen. Curtis E. LeMay failed to materialize although LeMay has requested resignation. He is currently serving as a reserve of duty for the Air Force. Pennington observed that the absence of strong congressional pressure to retire LeMay in his present post.

AF Academy Foes Face Strong Foes

Air Force may face difficulties in getting money to start USAF academy from House Appropriations Committee. Legislation authorizing the academy might through the House as a 25- to 30 vote. Senate approval by an overwhelming margin is expected.

Chairman John T. Hines of House Appropriations Committee and chairman Ernest Gruening of the Air Force Appropriations Subcommittee both are opposed to it.

►\$400 Million—Some claim the academy's total cost will be \$150 to \$180 million, instead of the \$225 to \$275 million USAF estimate. In addition, it objects, it will take down the same amount to operate as the \$165 million a year required for West Point and the \$25 million for Annapolis.

Inside Aerojet

William J. Condon, Aerojet's West Coast Editor, is the first American permitted to visit the secret test facilities and laboratories of Aerojet-General Corp., a leader in guided missile work and largest manufacturer of rockets in the U.S. The latest developments in the field of rocket propulsion and the theory of Aerojet's growth to its present position are told by Condon in this issue. The story begins on page 38.

In House debate, he concentrated "on an attempt to find that the Navy plan will be able to carry out the three goals by attending Annapolis without need for a separate Naval Air academy. And what about a separate academy for our rapidly growing Army mission?"

►Condon's—Also opposed to the USAF academy, Rep. Peter Mack, aviation enthusiast who made a last, ditch-grading flight in a Beech Bonanza in 111 days a few years ago.

He claims that what is needed is a consolidation of West Point and Annapolis into one military academy for all the services.

CAB Calls Airline Fares Read Bargain

Air transport industry is providing one of the best bargains available to the American consumer, Civil Aeronautics Board says in its report to Congress on fiscal 1955 activities.

Despite a unitized deficit in purchasing power of the dollar, average passenger fares per mile dropped from 9.8 cents in 1949 to 5.5 cents in 1953 for the domestic market, CAB says. In the same period, international fares declined from 7.0 to 6.85 cents.

"Airline service, as being made available to an ever-increasing number of the traveling and shipping public, and increasingly those services are becoming safer and generally less expensive," the report states.

All categories of traffic and all sizes of traffic movement, except Alaska, showed substantial increases in volume over 1952, the Board reports.

►Passenger—For the domestic market and feeder lines total 15.8 billion in 1953, U.S. international, ocean and territorial carriers, 5.5 billion and all other carriers, 4.1 billion. Cargo tonnage in the same date grew 184 million, 91 million, and 175 million, respectively.

Arthur Godfrey Faces 30-Day Suspension

Civil Aeronautics Administration last week asked for a 30-day suspension of Arthur Godfrey's pilot's license. The request was made in a report prepared by CAA attorney S. W. Behr.

Godfrey, after several hearings by CAA, charged that he "unintentionally" acquired his personal DC-3 in a belief of Teterboro, N. J., airport and board the airport Jan. 7 (AVIATION WEEK Feb. 5, p. 14).

Denied evidence of the charges was that of Civil Aeronautics Board along with the request for 30-day suspension. Observers believed CAA would allow the CAA recommendations.



THIS BIGGY FUMES McDonnell XV-1 with on-sterling landing gear at Lambert Field, St. Louis, Mo. It will fly next summer.

XV-1 Prototype

- McDonnell design mates piston prop, jet rotor.
- New craft is first of three convertiplane types.

McDonnell Aircraft Corp.—last of the three major convertiplane companies to produce a prototype—last week unveiled its XV-1 design, combining conventional piston-propeller power with jet-driven rotor blades.

The XV-1 represents one of three varied approaches to the convertiplane problem sponsored by the Army Transportation Corps and developed under auspices of the Air Research and Development Command. The others:

- **Bell Aircraft Corp.**, which is building its XV-3 prototype, based on the tilt-rotor concept that allows the same piston-engine combination to be rotated through a 90 deg. arc for vertical lift and forward speed.
- **Stearns Aircraft Division** of United Aircraft Corp. still in design stage, emphasizing an air-actuator rotor principle that allows the rotor to be folded and retracted into the main fuselage during forward flight.

Shortly does not have a Phase 2 prototype construction contract, because it has not completed its Phase 1 design study. The Stearns proposal has undergone several design changes but is believed to involve a two-blade retractable helicopter rotor and gas turbine powerplants for forward speed. Prototype probably will be completed by 1957.

►Combination—Airs—All three types of convertiplanes will be evaluated by the Army for possible use as liaison and observation planes for the ground forces. All are aimed at combining the vertical-lift and landing characteristics



LONG NOSE rises up much of 30-ft. length. Skid beams look height a 10 ft.

ties of the helicopter with the forward speed of a conventional aircraft.

"The XV-1 uses a three-blade, jet-powered rotor for its vertical landing, takeoff and hovering operations and a Conquestor piston engine driving 150 hp to a McCauley two-blade steel propeller for its forward speed. The Conquestor engine is mounted at the rear of the fuselage under the wing. Forward thrust is provided by the engine's airframe at the wings. The piston engine drives a blower that supplies an under pressure to the rotor hub located at each rotor tip.

►Forward Jet Rotor—When the jet rotor is in use, the piston propeller is folded and feathered. When forward speed is desired, a clutching arrangement disengages the engine from the rotor and transfers its power to the piston propeller. The rotor is allowed to accelerate to a maximum ring position during forward flight.

Full is in the 180 deg. jet through a rotor hub gear drive from the rotor hub's forward drive. To eliminate the piston jet rotor, first developed by McDonnell experimentally on its Little Horn concept before it is possible to use either rotor blades and a higher disk loading than

would be possible on a conventional piston-propeller. The top tip also characterizes the steel for an ultralight nose.

►Stability—The XV-1 can carry three passengers in addition to the pilot in its long, P-40-style cabin. The cabin is separated from the engine compartment by a firewall bulkhead. For landing purposes an retractable and swivel can be used in tandem with dual controls. But doors can be utilized in an emergency.

The XV-1 aircraft configuration is a high-wing monoplane with two horizontal. The 20-ft. span is retractable, because the wings are not required to produce lift during low-speed landing and takeoff operations. They have full span, low-blended wings.

Each of the two main beams has a conventional-type wing. A horizontal stabilizer with light trim tabs controls the two vertical fins. Forward end of the fuselage has been cutback across the wing chord for use as a tail fin. **►Two Sealed-1-1**—A single gear uses four main wheels supporting two aluminum, non-retractable skids. Skidless steel strips are hinged internally to these landing skids on the longer principle to absorb the blows of uneven, hard landings.



NORTH AMERICAN T-6 Texan fitted with glass-plastic wings undergoes WADC tests.



COVER WING PANELS show bond contact with aluminum-skinned center section.

WADC Tests Glass-Plastic Wings

Preliminary flight tests involving approximately 1,500 lb. have been completed successfully with a pair of fibrous glass-plastic wing panels under evaluation on a modified Air Force T-6 trainer.

The proving trials have afforded accurate data in an experimental program at Air Research and Development Command's Wright Air Development Center, Dayton, Ohio. Aim of the study is to establish design and performance factors for low-pressure, glass-reinforced plastic laminates in aircraft structures (Aviation Week June 1, 1953, p. 59).

Metal Stubs: The photos above show where the plastic panels are joined with the aircraft's metal center wing stub at the lead fitting. Construction of the metal stub wing is accomplished with a metal stretch angle attached to the plastic structure's inboard end with adhesive and bolting.

The wing panels were constructed for the Air Force by Ray Coats Associates,

Inc., Yonkers, N. Y., a subsidiary of Republic Steel Corp.

Sandwich material is cellular cellulose acetate bars wrapped with cross-impregnated fibreglass cloth. Core thickness varies from about 1 to 4 in. Sandwich faces are fibrous glass-cloth laminates, varying from seven to 40 plies, depending upon the load to be reconstructed on the various wing areas.

234th: Kees-Wing beam members also are constructed with GCA resin bars and fiber laminations that vary from about 23 plies at the root to five at the beam tip end. Beams are returned to skin formed by glass-reinforced, wrapped, triangular GCA strips.

The wing panel's upper and lower skin sandwiches, and internal structure are held together by an assembly fixture during curing.

A laminated channel girder for the

leading edge enters nose joint is applied in a subsequent curing operation.

Fast Flight: The ECA built wings are the first to be test flown. They were delivered about two years ago. Three timely experimental panels were designed and constructed at Wright as early as 1944 in structural proving. ECA also built a static test article that went to about 180% of ultimate design load in the critical condition (quarter high angle of attack).

\$431-Million R&D Budget Satisfies AF

Air Force is satisfied with a \$431-million research and development budget for fiscal 1955, more than \$165 million under that year's \$595 million, according to Trevor Goddard, special assistant for research and development to the Secretary of the Air Force.

Goddard says the \$431 million figure is USAF's accommodation and not the result of trimming by Defense Secretary Charles Wilson or Undersecretary Roger Kees, who "fully support a strong weapons research and development program."

Last year, Goddard was skeptical of the reductions made in the Truman budget for USAF research and development by Wilson and Kees and projected a Wilson-Kees order lowering 25% of the research funds in the fiscal budget (Aviation Week July 27, 1953, p. 13). The figure later was lifted.

Wilson Support: "It is a disappointment to us as active in the fiscal 1953 research and development budget should develop, I am sure both Wilson and Kees would support it—even if it were a substantial increase," Goddard says.

Here are Goddard's observations on aspects of fiscal 1955 research:

Annual budget will drop from \$64 million in fiscal 1954 to \$53 million in fiscal 1955. This reflects a completion from development to testing stage of numerous aircraft projects and studies after Kees with 1954 funds, rather than a step-in effort, according to Goddard. He says since war projects will be reduced in fiscal 1955.

Guided missile budget will be increased from \$34 million to \$91 million and provide for initiation of several new projects.

Propulsion budget lower from \$77 million to \$60 million provides for launch of "50 lb test unit" new projects and an increase of effort in this field.

Avionics budget reduction from \$75 million to \$57 million reflects example from of military "black box" projects, started after the Korean outbreak, in the production stage with 1954 funds. Goddard says the same level of effort will be retained for air defense avionics research.



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will be continuing down in the congressional battle at the budget time.

• Democrats, who will center their fight on additional funds for ground forces but also demand more USAF money. They claim the defense budget was down with fiscal considerations and not defense requirements of the United States in mind.

• A powerful group of conservative Republicans, who will run at odds in most military outposts. Chairman John Tower of the House Appropriations Committee is among at a \$1- to \$1.5 billion cut in both the \$34.9 billion in new money and the \$17.5 billion spending program for Defense Department recommended by the Administration. Sen. Edward Brooke wants to go further and trim \$1 to \$1 billion.

• Administration outgroups, such as Senate Minority Leader William Knowland and chairman Everett Schmitt of the Senate Armed Services Committee, who will try to stress the Democratic side for budget increases and the drive for cuts.

• Rapid Action—Congress has moved rapidly on the fiscal 1975 budget.

• Senate Armed Services Committee has held several weeks of closed-door listening sessions with Defense Secretary Charles Wilson, the Chiefs of Staff, the Secretaries of the services and their staffs. The sessions were required by Sen. Richard Russell, ranking Democrat on the committee. Democratic members wanted to be thoroughly informed on the "new look" program. Symington is a member of the committee.

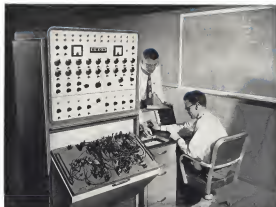
• The full House Appropriations Committee has opened fiscal sessions to hear top defense officials. The committee shortly will break up into three subcommittees. Subsequently will handle budgets of the three services. The Air Force subcommittee: Rep. Ernest Brown, chairman, Ronald Hruska, and George Milner.

• Better View—Democratic opposition to the Administration's "new look" is dimmed at Secretary of State John Foster Dulles' Jan. 12 speech, in which he explained.

"The basic direction was to depend primarily upon a great capacity to resist, notably, by means and at places of our choosing. Now the Department of Defense and the Joint Chiefs of Staff can shape our military contribution to fit what is our policy instead of having to try to be ready to meet the enemy's many choices. That permits of a provision of military means instead of a multiplication of means."

Rep. Albert Gore observes: "Certainly there is nothing new in placing great reliance upon the ability to render devastating retaliation against an enemy who might provoke war upon

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ENGINEERING processes are undergoing a revolution, thanks to GEDA—the Goodyear Electronic Numerical Differential Analyzer—a compact analog computer which greatly accelerates the design of complicated equipment and systems.

A big advantage of GEDA is the fact that engineers do not have to learn specialized mathematics in order to use the computer. Once the block diagram is laid out, it is a simple matter to set it up on GEDA's problem board.

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So now he is encouraged to "play his hunches." A

new idea can be tried out or a component of a system can be changed as easily that new approaches to a problem can at last be profitably explored. Even problems dealing with dynamic systems, where conventional solutions seem impossible or too time-consuming, can be solved by GEDA.

The GEDA line of equipment includes both linear and nonlinear analyzers, six-channel console recorders, and servo-followers—offering flexibility and scope to meet specific individual requirements.

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MAJOR USE...the new T-60 is available for use on both primary and secondary cables...for cables from 10 lbs. to 600 lbs. Obviously use cannot damage the instrument.

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MODEL P-3 shown in standard 0-160 lb. tension range, or other range for other cables.

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Army Aircraft Procurement

Here is the obligation and expenditure pattern for helicopters and light planes by the Army since June 1950

(\$100,000 rounded)

	1951	1952	1953	1954	1955	Total since the Korean outbreak
Obligations	\$110	\$80	\$72	\$90	\$10	\$450
Expenditures	\$7	\$11	\$95	\$50	\$60	\$203

so that has been our policy for several years.

"But it is difficult for me to assign a satisfactory substitute for strength at or near the point of weakness or danger. I strongly doubt if the finest or absolute will suffice, particularly in those cases which appear on the surface, at least, to be local in nature."

Mosquitos Converted For Business Flying

Approximately 20 World War II de Havilland Mosquito fighter-bombers have been acquired by Aviation Export Co., Ltd., Los Angeles, for conversion to high altitude photographic survey or 400-mph. business planes.

First Mosquitos being converted by the firm for aerial survey missions are nearing completion. Its pressurized equipment will be capable of maintaining the equivalent of 4,000 ft. altitude while flying higher than 45,000 ft. the

company reports.

Powerplants will be late model, Packard-built Rolls-Royce Meritons, giving the plane a cruise speed of more than 400 mph, at 40,000 ft.

The first Mosquito conversion is scheduled to attempt a round-the-world speed record with Max Dunn, Remy, its former owner, piloting the craft. "The flight will be sponsored jointly by Aviation Export and Young Tiger Lines."

Robert Prescott, Flying Tiger president, became interested in the Mosquito conversion project and agreed to supply labor and shop facilities in return for an interest in the plane, according to Aviation Export. Conversion cost is \$125,000.

The business plane conversion of the Mosquito is estimated at \$240,000, says the company. Presumably, the plane will be capable of carrying two passengers.

The Mosquito is of all wood construction including covering. Thousands were built during the war.



Boyd Inspects XT-37

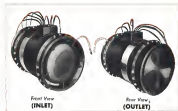
Maj. Gen. Albert Boyd (right) is seen with Captain Anson C. G. president Donald E. Walker by making of company's new transport XT-37 (shown) (shown above) which the Wright Air Development Center commanding general inspected recently. Boyd shows some changes compared with earlier aircraft, and satisfaction of looking light as transport now. Boyd and he look forward to flying the XT-37 this year.



Here's How This JOY AXIVANE® Aircraft Fan Solved a Problem of Unmatched Complexity

WHEN the Air Force and Coast substituted Vulture, manufacturer of the B-46, decided it was necessary to have a pressurization booster on this big new bomber, they really threw the design-book away. The requirements for the booster would cost any prospective fan supplier to have meaningless Specifications called for three separate fan-fan-fans!

- a. 1200 CFM at 32" I.P.G., with an air density of 0.004 lb./cu. ft.
- b. 700 CFM at 40" W.G., with an air density of 0.10 lb./cu. ft.
- c. 600 CFM at 20" W.G., with an air density of 0.003 lb./cu. ft.



Space and weight limitations were outrageous. The fan had to operate under excessive horsepower requirements due to a central load on the generators. In addition, the fan motor had to be protected from hot air in the duct system.

Just about when the job seemed impossible, it was turned over to Joy engineers.

The result? Not only was the problem solved to the complete satisfaction of both the Air Force and the manufacturer, but the passenger fan was in their hands only six months after Joy received the order.

The fan exactly meets the three duties specified. It is 10" in diameter and 17" in length. Because of its combination of magnesium and aluminum construction, the fan weighs only 14 lbs. It is a two-stage unit, driven by a two-speed, 400-cyclic motor. The efficiency of vane-inlet fan design permits using a motor rated at only 13.6 H.P. continuously duty. The stationary vane which supports the motor see hollow, so that cooling air can be continuously directed over the motor. Each stage of the fan has a set of vane-inlet vanes. Cooling and blow-down vanes are a single com-

ing for shock-resistant strength. • We freely admit that this is one of the toughest fan design problems Joy engineers have ever tackled. On the other hand we are just as sure that, in the future, even harder problems will be taken on and solved. Even if your aircraft fan problem is not a difficult one, it is a good bet that the incomparable vane-inlet fan design know-how which produced the AXIVANE fan will give you the most fan for your money. If you need an aircraft fan for any purpose, call on JOY—the world's largest manufacturer of vane-inlet fans.

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AF Asks \$75 Million For Overseas Bases

Air Force has asked approval of \$44 million to start construction on four major bases in Spain and \$33 million to complete work on 17 medium bomber bases in the United Kingdom.

The request was made to House Appropriations Committee, which must pass on all new military construction.

Of the UK bases, all but three of the 17 now are operational. In addition, USAF declared it has approved the Secretary of Defense for \$49 million for construction at two other UK bases at Eindhoven and Staps.

• **Radar Net**—Cost of the four bases in Spain is estimated at \$98.5 million. The major base, near Madrid, \$43 million. Marcan base, 50 mi southeast of Seville, \$13 million. El Capitan base, five mi north of Seville, \$32 million, and the Zaragoza base, \$13.5 million.

The air bases and seven outposts of the Navy plans to construct in Spain will be connected with a 570-mi fuel pipeline. In addition, USAF will construct a radio net in Spain performed after the construction of U. S. bases.

• **\$570-Million Cost**—USAF estimates the total cost of the joint U. S.-British bomber base program at \$570 million. Cost Britain is contributing \$55 million in cash and \$70 million in existing usable facilities. The U. S. is contributing \$275 million in cash and \$23 million in engineer labor.

Under the agreement with Spain, the U. S.'s 10-year term the rights dates from the signing Sept. 26, 1953. Actual construction work is not likely to start for six or six months.



New Stripe for 377

Pilot stripe reaching to the tip of Boeing 377 Stratocruiser's tail replaces former Northwest Airlines' paint scheme that dominated our entire portion of freighter. Airline was now making attempt to add bright to the Boeing and some one-half gal. of paint, 14 lb. of weight, 22 man-hours of labor and 24 hr. of elapsed time to apply.

from Research through Production

Rhodes Lewis Company, a wholly-owned subsidiary of McCulloch Motors Corporation of Los Angeles, designs and produces specialized types of precision-made pneumatic and electro-pneumatic accessories for the military and for a variety of industries throughout the world.

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P2V Stinger Production Details Revealed



SEVENTEEN-FOOT PLASTIC wings built by Zenith become sub-bearing equipment in tail of Navy's Lockheed Neptune submarine hunting patrol plane.



CRADLED UPSIDE DOWN outside plant, new plastic stinger shows its beautiful skin, free of tail coming. Dimensions shown are about 6 ft. by 4 ft.



LOOKING REARWARD into mirror of glass bubble-shaped windows structure (left photo), shown, all stingers, bulkheads and wings are preformed. The so major sections that make up the stinger tail are built out in front of completed unit (right). In background is reasonable tailcone that houses P2V's respective lights.



• Plastic tail extension needs one-fifth as many engineering manhours as its metal equivalent would.

Facts evidence that the reinforced plastic structure is rapidly extending its field of application in aircraft as new design and production details on the Navy's P2V Neptune patrol plane's "stinger tail."

The reinforced structure stretches 17 ft. from the end of the Lockheed-built submarine hunter, opening in a cone from a forward dimension of 6 ft. deep and 4 ft. wide (Aviation Week June 15, 1955, p. 43). It houses new equipment that provides underwater cut.

► **Composites—Contracted by Zenith Plastics Co., Gardena, Calif., the reinforced plastic structure can be produced like other units of this general type, with 4 ft. engineering manhours, or 1/7 the factory floor space, with 1 ft. production manhours and with 17% of the tool and equipment costs of that required for the equivalent metal structure, it is claimed.**

Weight of the stinger, compared to that of the lightest practical metal equivalent, is about two-thirds, it is reported.

► **Manufacture—Schedules—Details of molding and tooling applied recently to Avianco Wren by William E. Beatty, Zenith's chief engineer, reveal that after studying many materials and types of structures, Lockheed engineers selected a monocoque laminated sandwich construction employing glass cloth impregnated with Sphéron polyester resin.**

The stinger tail has no struts, ribs or bulkheads other than those around its joints.

The unit, Zenith built for test-destruction showed no signs of failure or local deformation up to about 300% of the ultimate load.

► **Five Sections—From advance copies of Lockheed production drawings, left and templates, Zenith engineers began tool design and planning for the production schedule.**

To meet the requirements specified for every dimension and actual shipment, the stinger structure was produced in five basic sections. Six large molds were required. Zenith decided to use the metal-pressed type for occasional production of the sections within the required close tolerance for

The Flexbelt Valve may be used with all other remote control valves. It has a built-in valve body which allows the valve to be closed or opened by means of a remote control. It is a simple, reliable, and easy to install valve. It is available in a wide range of sizes and materials.

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FLOW CHARACTERISTICS: Linear, non-linear, high-flow, low-flow, pulsing, etc.
OPERATING PRESSURE: Up to 1000 psi maximum.
ACTUATING SPEED: 2 seconds from full open to full close. 110 to 60 cycles at 50 to 400 cycles per minute.
POTENTIALITIES: From 10,000 to 100,000 cycles in service life.
ANALOGOUS: For remote control of fuel flow in aircraft engines.
MATERIALS: Light weight aluminum, stainless steel, valve—stainless and aluminum steel. Flexbelt—flexible glass fabric, reinforced by synthetic or organic polymer. Gaskets—self-lubricating powdered metal. 1/4" to 3/4" size. 1/4" to 1/2" x 1/4".

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SIMPLE MOLD takes place of all dies and fixtures which would be required to make mold direct from master of parts.

interchangeable parts, Resham says. Fabricated in Zenith's tooling department, this type of mold has been used for the construction of the high caliber on the Navy's Super Cruise (Aviation Week, Dec. 7, 1954, p. 18).

Along with the molds, two assembly fixtures were designed. These also served as drill jigs for the mounting holes in the trigger sections.

Tool designs were submitted in late about 1957, and production planning and material procurement about 1958, at the time required for an equivalent metal fixture, it is reported.

► **Pattern First**—In the construction of the molds, mockups first were built of the outside mold lines of each section of the chamber. Each of these mockups consisted of metal fragments cemented on a steel fixture supported on a heavy baseplate.

Rough, reinforced plaster was used to fill the spaces between the templates to within about 1 in. of their edges. Then fine finish plaster was used to level plaster sections past the template edges.

Finally, the finish plaster was swept so to expose the edges of the templates, Resham says, and heavy reference lines were scratched into the mockup surface before it was dried.

► **Plaster Cast**—Plaster splashes, or casts, were made from each completed mockup to obtain basic molds of the outside mold lines of each part. For handling ease and to eliminate warpage, these splashes were rigidly attached to steel frames.

After the splashes were dry, duplicates of the mockups were cast in plaster. These also were fitted with a welded steel structure, similar to those used on the splashes. These duplicates were used as the basis for the design of mold spray metal.

Before the metal spraying was begun the reference lines transferred to the duplicates were scratched.

► **Metal Spray**—In the metal spray process, a final coat of steel was de-

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postured first, followed by a build up of about 5 in. of bronze. Then, to give additional metal and strength, aluminum was sprayed over this, so that final metal thickness was between 1 to 1 1/2.

The amount of metal sprayed on the mold, and its distribution, is dependent upon the heat required to cure the acetone produced in it, Shoben says. Careful consideration must be given to parts which have varying material thicknesses local build up of solid laminate, and similar details, he points out. Other factors to be watched are distortions caused by the varying temperatures to which molds are subjected, surface porosity of the mold and its strength and durability.

► **Flame Backup**—Following the spray operation, a 1 in. thick shell of bronze and glass cloth impregnated with butylacrylate polyester resin was laid up over the exposed metal surface of each tent for backup. An adhesive, plus action of the resin, around the shell to the tent.

A custom-equipped metal frame was attached by means of prepositioned glass-cloth strips to the backup shell. The plaster diaphane was removed and the custom frame and mold was then set upright.

Final preparation of the molds for production involved peeling out the zinc flash coat, trimming mold edges, accumulation of reference lines. With the zinc coat removed, the hard, smooth, glass bronze was left for the mold surface.

► **Structure Backup**—In the layup process, the resin-treated glass cloth is laid out on work tables over heavy brown paper and the correct number of plies are built up for the outer skin. After all wrinkles and air pockets are worked out of the laminate it is then forced to the mold, which is coated with a release agent.

The pre-cut resin-treated glass-cloth honeycomb is laid up on this laminate, with reference for the solid, built up laminate. Over the honeycomb an outer laminate is laid up to form the inner skin of the sandwich structure.

► **Casing**—The entire content of the mold is covered with a thin transparent plastic sheet hermetically sealed around its extremities, which come to the edges of the mold.

A blanket between the sheet and the inner skin prevents the two from sticking. A vacuum line is attached to the mold to provide for application of atmospheric pressure to the layup. Traps serve to draw off extra resin and gases.

The mold is then rolled into controlled-temperature ovens and after the requisite curing period is removed and cooled.

After removal from the mold, the ac-



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tion is tough teamed with a hand saw. Most fuel tank operations are done with a portable, automatic, thickness sander. This small Zurich developed lightweight tank, designed to maximize cost of production, close tolerance, thickness, no curved parts, has indices that can be set to permit following of the contour on the part on which it is mounted, virtually unattended, Beckman says.

Power source is an air motor fed by a flexible hose attached to the plant air supply.

► **Assembly**—After completion of trimming, the sections are put together in the assembly fixture.

One fixture is used for the forward structure—consisting of a top and two side sections. These three components are joined with rows of bolts passing through holes drilled in solid laminated glass fiber resin. At the front edge of the forward structure, extruded aluminum alloy angles are riveted to the sections and drilled to accommodate bolts that attach the stringer rail to the fuselage proper, Beckman notes.

At the rear of the forward plastic structure, a built-in solid laminated glass cloth angle serves as an attachment ring for the aft stringer portion. This laminated ring also is drilled in the fixture, attaching bolts.

The second assembly fixture, though embodying features similar to the forward fixture, is smaller and somewhat simpler.

► **Finishing Up**—From the assembly fixtures, the sections are drilled to the point shop for a color to match that of the aircraft.

Beckman says that the plastic materials are impervious to the extreme climate and environmental conditions encountered in service by a U. S. Navy plane, so actually no protective coating is necessary.

Forward and aft sections of the stringer are shipped in two containers to Lockheed for fitting with equipment and attachment to the P2V's fuselage.

—Irving Stone

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A new hydraulic facility, available to industry for research problems involving pressures above the capacity of present equipment or for high pressure pipe calibration, has been installed at the University of Detroit.

Part of the university's Department of Engineering Mechanics, headed by Prof. H. E. Mearns, the equipment can be used for pressures up to 14,000 psi, a value not commercially available in laboratories.

Inquiry regarding the equipment should be directed to Prof. Mearns at the university.



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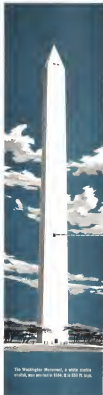
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Ball-and-Socket Block For Angle Drilling

Angle drilling at Temco Aircraft Corp., Dallas, is now a fast and easy job—even for inexperienced jig or tool-makers. Drilling on contoured surfaces also has been made easy.

► **Ball and Socket.**—The answer is a new tool—a ball-and-socket drill block—designed by Temco's R. C. Buford.

The new "universal" block measures $3\frac{1}{2} \times 4\frac{1}{2}$ in., and is made from 11-en-thick tool steel. The center hole, bored for a 1 in. bushing, is centered in a ball, which in turn is enclosed in a socket. Radius of both ball and socket is $2\frac{1}{2}$ in., and to insure that the ball is movable, the block is cut through from one end to its junction with the socket.

This cut widens the socket apertures fractionally, and the socket shell—made of two separate, non-circular pieces, held in the block by set screws—slides just enough to give the inclined ball sufficient clearance to move.

In this way the ball and the bushing hole within it can be tilted to any desirable degree for angle drilling. Once the tilt is established, the ball is secured in that position by tightening a locknut which closes the nut on the block, tightening the socket.

When the angle must be exact, the bushing hole angle may be preset by setting on a sine plate.

► **Logs for Run-In.**—To cope with drilling on contoured surfaces, the ball-and-socket block has socket-and-pinchers threaded caps at five points, including the block's four corners. These screws can be run out so that they extend like logs from the base of the block. On an irregular surface, the length of the screws is adjusted so that they make a solid base for the block. After this, the block is clamped to the surface.

Temco uses the universal block principally for edgework holes, but the unit is equally useful for beveling holes. It can be used with a hand-operated drill, or with a drill press.



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AIRVIEW SHOWS 105-ACRE Azusa plant, devoted to research, development, testing and pilot-production of rockets

Aerojet Plays Major Role in Rockets

In a dozen years, employment has grown to more than 4,000; firm is active in almost every U. S. guided missile program.

By William J. Coughlin

Azusa, Calif.—Since its organization as a small research firm only in World War II, Aerojet-General Corp. has grown quickly but mostly in headspace in the rocket propulsion field. It now is the largest American rocket engine factory, active in almost every U. S. guided missile program.

The company's rapid growth has been concealed behind a curtain of military secrecy for more than a decade. That secrecy now has been lifted slightly for the first time since Aerojet's organization in 1942 under the guidance of Dr. Theodore von Kármán, well-known aerodynamicist, who still is consultant to the company.

■ Cause the Field—It can be revealed that Aerojet-General has supplied powerplants, boosters or components for nearly every U. S. missile, in addition to important work in guidance, tracking and control. Launchers, sustainer, gas generators, catapults, underwater propulsion devices, and turbine starters are among its contributions.

Little has been heard of the firm for a very good reason. "What a company works in the field of rocket power, most

of the designs on its drawing boards are highly classified. Aerojet-General is no exception.

Many engineers of the future, however, may have one thing in common: whether they are broad-based specialists lumped out of the corner, sub-specialists making out and out-drawing every inch, or rocket-powered technology being moved as energy weapons. They may be powered by units developed by Aerojet.

Aerojet Expansion

Aerojet-General Corp. has announced plans for a \$2-million expansion of its facilities near Azusa, Calif. Besides Sacramento, Aerojet has operations in Azusa and Culver City.

E. E. Nichols, assistant engineer at the Sacramento plant, says the expansion will be financed by the federal government to implement the company's facilities for manufacture of engines and boosters for pilotless aircraft such as the Nike and Regulus. Located on a 700-acre site, the plant has been producing rocket and missile units.

Aerojet-General's designs range from the Aerobee sounding rocket which has attained heights of more than 55 miles (Aviation Week Aug. 17, 1951, p. 794, Feb. 1, p. 50) to the massive rocket engine test chamber at Edwards AFB (Aviation Week Aug. 31, 1951, p. 240).

Best known of Aerojet-General's products are undoubtedly its Ramjets, which provide sustained-thrust boost for both military and commercial aircraft. These include the new 1958 1050 sustainer and the earlier 14AS 3040. This is the only rocket which the Civil Aeronautics Administration has approved for use as a passenger-carrying commercial aircraft, both as a source of emergency standby power and as a thrust-boost power. It also has been used for years to provide additional thrust for all types of military aircraft. Over a quarter-million have been supplied for service use.

■ How it Grew—When Aerojet-General was organized, its immediate purpose was production of rocket power and its military applications. For more than 10 years, Aerojet has devoted its attention almost exclusively to that field.

The firm became a subsidiary of General Tire & Rubber Co. in 1944.

To this pool of research and financial talent was added recently the massive thrust know-how of Grady Mottau, Inc., which merged with Aerojet early in 1953.

President of Aerojet-General is former Navy Secretary Dan Kanell. Kanell has been affiliated with the General Tire & Rubber Co. since 1932, except during the period of his service in the Navy Dept. from 1949 to 1953. Executive vice-president is A. E. Rode, who long associated with the General Tire organization.

The well-served team now operates four plants. Research, development and testing are done at the main plant here in Azusa, a suburb of Los Angeles. Production is manufactured at a sprawling 8,400-acre plant at Sacramento, Calif.; metal parts are fabricated at Culver City and Maroon, Ind., as well as Azusa.

The firm has grown from five men in 1942 until it now employs more than 4,000. Its backlog is more than \$150 million.

■ Research is the Air-Airborne money goes to production, the other way around at Aerojet-General is chiefly one of its secrets. Its scientists are peering into the black Roger field of tomorrow's power, rockets. To talk to the man heading Aerojet's division is to receive a thorough briefing on all 5 programs in this field as security will allow. For three men talk outside-the-office not only of tomorrow's missiles but of the military vehicles and space vehicles of day after tomorrow.

Managers of the liquid engine division is Chandler C. Ross, a specialist in pumps and burners, who was a major contributor to the design of the first turbo-propellant test for a turbo-rocket.

The division is concerned with such items as missile powerplants, boosters, stored-thrust rockets, solid-state power units, and research into advanced and future applications.

"The rocket powerplant is well ahead of combustion fields in its development," Ross tells you. "Rocket powerplants are well-defined compared to other problems such as thermodynamics and aerodynamics."

■ Combustion Mystery—Greater problem here is U. S. solid and combustion power on the frontier of research, he says, is that of suitable combustion-pressure burners which can take a rocket engine apart in half a second—a phenomenon so destructive that engineers suspect gas atomization on it.

Whether this is caused by mixing before combustion, combustion itself or whether it is a fault of the complete system remains a mystery, according to Ross.

The Germans did not seem to have



14AS-1000 RATO sustains thrust of missile as it boosts FIV at Phoenix



15KS-1000 RATO, newer sustainer style, boosts FIV in another boost



LIQUID-PROPELLANT drop pods, reusable rockets help B-45 get up

a major problem with it," he says.

■ Liquid Propellant—The major reason Aerojet-General has not had large-scale production of liquid propellant engines to date, according to Ross, is development time that has been required to meet both U. S. standards for safety and reliability.

"USA" requires that anything as as complex as very safe," he comments. "The Germans and maybe the Russians do not insist on that."

Development has accompanied the safety and reliability hurdles, and liquid

rocket engines will now take their place in most fields and even power powerplants for aircraft, as their inherent advantages of simplicity and reliability become recognized, according to the Aerojet objective.

"The liquid rocket engine is now out of the experimental stage," says Ross. "It is an engine because now."

■ Powerplant Problem—Other problems facing long duration rocket powerplants.

■ Shortage of material compatible with the fuels used. "Titanium will be a

a nose for business



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born to the rocket industry," says Ross. "Light weight of rocket engines is counterbalanced by high specific fuel consumption. Although altitude and speed advantages are realized, fuel requirements limit range."

• **Specialization of engines.** Rocket engines, unlike other engines, are tailor-made for the mission. You cannot to meet costs take the engine out of your aircraft and use it in another.

Despite these problems, Ross said: "The U. S. now is in a position to build rocket engines for almost any requirement that is in sight."

The reliability and safety problems of rockets have been solved for certain applications, Aerojet-General reports, particularly in the field of auxiliary power units for jet-propelled drives. Among all savings will be long storage life and ability to operate through varying extremes of temperature.

• **Cost.** Production—Aerojet-General has developed both liquid and solid propellant gas generators for pump drives and for the displacement of fuel under pressure. It has manufactured many different sizes and types of gas generators and pumped rockets. These deliver thrust ranging from 1,000 lb. for four minutes to nearly 100,000 lb. for a few seconds.

The intensive study of gas generators at Aerojet-General also led to the design, construction, and operation of the largest U. S. liquid-gas injection plant.

Liquid-propellant assist-takeoff rockets have been used in several military actions, in some cases as catapults. These have reduced takeoff run of heavy bombers by as much as 90%.

The military has used the Aerojet, a two-stage, liquid-fueled rocket, for super-boosting aircraft. It is powered by a bipropellant liquid rocket engine and is accelerated initially by a large booster rocket, which detaches and falls away after launching.

The Aerojet has been flown from the Army's White Sands Proving Ground, from Holloman Air Force Base, and from the USS Norton Sound off the coast of Peru and in the Gulf of Alaska.

Forward-firing aircraft rockets (FYAR) produced by Aerojet-General have been used in air-to-ground and air-to-air combat.

• **Blackburn Two-**The firm also built the Blackburn Two—the first also built the New Mexico, designed and aimed in consultation of Air Research and Development Command's gunnery rocket engine test facility at Eglin AFB, under design of the Naval Air Warfare Test Center at Ft. Meigs, Calif., and incorporated down-range trials at the Air Force Missile Test Center in Florida, as well as refueling some of the special instrumentation at Redstone Arsenal.



ENGINEERING section works on building designed and built by Aerojet



ROCKET STAND is part of company's extensive Aero test facilities

Aerojet-General has in fact a complete architecture and engineering division. To the assessment of local conditions, it built its own operating and structural administration and engineering building here in a cost of \$491 a square foot, less than half of most building costs.

What is a rocket propulsion firm doing in the architecture-engineering business?

Due to the unusual nature of its work, Aerojet has had to fight against expansion into allied fields, with company executives taking a strong stand against weakening the firm by spending in talent too thin. In view of this policy, Aerojet's entry into the building field is even more unusual.

• **Rocket Test Base.**—When it became apparent some five years ago that large rocket engine test facilities capable of handling thrust approaching the half million-pound mark would be needed, the Air Force realized that the construction of such research facilities

would be beyond the scope of individual companies.

In addition, if a single company were to possess such a large facility—built with Air Force funds—it would give that firm an almost exclusive monopoly on high-thrust rocket engine work.

USAF therefore obtained the money for creation of a large rocket engine test station on Eglin Air Force Base at Eglin AFB. A chief of architectural firm, however, realized that some possessed the technical know-how in rocket testing regarding design and construction such a base.

Aerojet was asked to do the job. Although it had no architectural staff in rank, Aerojet's work in the new field of rocket engines had required the firm to develop not only its own instrumentation but also the test facilities required for the high temperatures and pressures of rocket engine development.

Aerojet-General designed not only the housing rocket engine test structures and control stations at Louisiana

Ridge but even the administration looking, boards and committees. And it is the most modern segment of the 204,000-acre Edwards AFB.

From its completion of the work at Edwards, the Navy awarded a contract to Aerojet and the Ralph M. Parsons Co. of Los Angeles for work at its Ft. Muga missile test center.

From there it was only a step to work on the smaller Air Force missile firing range in Florida.

"We stepped into that field only because it required our specialized type of knowledge," explains vice president and general manager W. E. Zach. "The company's specialty is solid rocket propellant and the work associated with them."

Each To The Core—Then In, Aerojet General has stayed out of the overall field of large missiles, although it may back into it through its optical guidance division.

The firm believes that a ground-borne missile, as a solid, surface and engine manufacturing should remain apart.

"Aerojet is not interested in entering the large defense business," says Zach. "We believe the separation of solid-propulsion, engine, actuation—such as the Army's Nike missile system—deserves by Douglas, guidance by Bell Labs, and propulsion by Aerojet sub-contracting of one responsible agency—the Western Electric Co. is healthy and results in a better job."

One of the better scientists at Aerojet is Dr. A. L. Anderson, manager of the solid engine and chemical divisions. After working his degree at Massachusetts Institute of Technology, he was engaged in pilot plant development and operation for the Standard Oil Co. until he joined the Aerojet company in 1946.

Propellant Research—"Aerojet started in business and stayed in business by departing from standard propellants," Anderson says.

The key to Aerojet's success in the field is its "building block" method of drawing on commercial operations of the nation for standard chemicals rather than relying upon new raw materials. Since this material is produced commercially and is available in large quantities, cost is cut considerably.

In adding an oxidizer to standard commercial plastics, for example, Aerojet has turned these into propellants in their own right. This use of synthetic building blocks such as nylon and Bakelite has eliminated the variability found in natural latex propellants such as nitrocellulose, according to Anderson.

Solid Propellant Line—Applications for the solid propellant include:

- Rocket suits, such as the space suits
- RKO-1000 now in production
- Guided missile propellants.



TEST CELLS at Aerojet plant are equipped with various electronic aids.



ARDQSE sounding rocket not liquid propellant propellant as Aerojet builds.

- Guided missile boosters such as those on missiles.
- Auxiliary power such for missiles.
- Starter for boosters engines.
- Emergency devices for electrical or hydraulic power losses of such nature as landing gear or flaps.
- Forwarding aircraft rockets.

The solid propellants are most efficient where high thrust is needed for a brief duration, Anderson points out. "The solid propellant is easier to store and more stable than liquid. Perforation is in grain, with the solid casting process 10 times as much in the liquid."

- Liquid Advantages—Since the liquid rocket engine, although more complex

ated, can be started, the high cost of its initial investment is paid off by use of inexpensive propellants and repeated use.

Due to low cost of the liquid propellant, economies also favor the liquid engine over for a single shot when long-duration thrust—60 sec. or more—is needed.

There is some overlap between the two types. The solid propellant sustainer of the Terrier, for example, operates longer than the liquid-propellant sustainer of the Nike, according to Anderson.

Liquid engines are also now an ending to compete with solid propellants in the missile sustainer field. One firm is working on a liquid version of the 3.75 rocket, according to reports.

Guidance—Missiles—Aerojet-General's work is not limited to rocket thrust. One of its most active divisions is the sub-rocket engine division, under the direction of C. A. Gougar. Although it can be declared that such thrust as rocket engines for torpedoes are being developed in the company's large water test facilities, much of the work on sub-rocket propellant design is hidden behind Navy secrecy.

But it doesn't take much imagination to realize that this division is well equipped to work on such items as helicopter missiles.

Gougar, a Cal Tech graduate, was with General Motors until 1948, then worked as a research engineer in the Division of War Research at Caltech University before coming to Aerojet in 1949.

Directing work at Aerojet is the field of optics, radiation, detection, electronics, guidance, automatic controls and electro-mechanical systems. In 1948, J. S. Wolfe, the former Navy commander supervised all rocket and guided missile propellant programs for the Office of Naval Research's before joining Aerojet in 1949.

Director of Quality Control for the firm is R. D. Grider. R. L. Dierman is in charge of test facilities, new instrumentation and testing techniques. His division field sensors, operations in use in all rocket testing.

Test Facilities—Thousands of test firings have been conducted at the company's proving grounds in Azusa, which are equipped for testing of thrust from 15 lb. to 100,000 lb. and temperatures from -100 to 1800°.

A tour of the test area discloses a rocket engine test facility at Edwards but as a smaller scale. In addition to employing the most sophisticated test equipment and instrumentation, Aerojet-General has developed its own type of pressure sensitive gages and sensors for recording test data. Also as a mode of test techniques in closed circuit test

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A compact new 400 ampere generator requiring only six inches of cooling air, with a weight of 4560-7000 rpm has been developed by General Electric to meet the needs of the nation's airlines.

First application of the new G-E generator is on the Douglas DC-7. All electric power aboard American's newest airliner is supplied by four of the new 30-kva, 400 amp G-E generators.

The new generator (Model 32M244) has the high rpm capacity of any wide-speed range industrial unit of its size (18,000 rpm). Resulting from G-E's continuous research in the requirements of commercial airlines, the new equipment offers these exclusive features:

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Exclusive features of new G-E generator on DC-7



SHRINK-RING COMMUTATOR withstands higher speeds without deterioration to insure long service life.



CORDED BRUSHES effectively pre-filing of commutator, improves commutation and reduces commutator temperature.



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venue for observation of test results.

Training programs are supplemented by the use of external applications, electronic analysis and mass spectrometry.

"The thing we have to fight," says general manager Zisch, "is the feeling that we're a bunch of half-eyed lunatics bent on going to the moon. But that we rocketeers won't eventually provide the powerplants for such a trip, if and when it's made, we sell. But right now we want people to understand that our work in nonverbal engineering and manufacturing of devices that have many applications where power is required."

"The rocket business is like any other business, an epic of its own planetary implications."

ARDC Scientists Study Jet Stream

The jet stream and its implications are being studied intently by Air Force scientists.

The Air Research and Development Command (ARDC), with cooperation from the Strategic Air Command, has established research flight points at McChesney Field and Patrick Air Force Base, Fla. Aircraft used in the studies include a B-47 based at McChesney and a B-29 at Patrick.

Weather, Speed Potentials—The jet stream project is conducted by the Complex Research Directorate (CRD), of the Air Force Cambridge Research Center, one of the major facilities of the ARDC. Scientists have found that weather can be altered by the location of the jet stream. It is believed that that energy from the stream can be transmitted downward to surface storms, or that energy from the latter may be carried upward into the jet stream.

As potential for lowering the speed of aircraft also is of interest to the military and the airlines.

Characteristics—The stream ranges over the northern hemisphere at heights between 30,000 to 40,000 ft. sometimes reaches 300 mph speeds. Findings show that the stream is about 400 mi. wide. It does not follow a straight path, resembling snake-like, zigzagging pattern slowly, meandering gradually as seasonal trends. More than one of these streams can be present at the same time.

Recently one stream was mapped moving in a southeasterly direction by the east coast, another came down from the northwest, through Canada and the Great Lakes region.

Robert Rados, meteorologist assigned to CRD's Atmospheric Analysis Laboratory, is project field director for the research.

IAS Summaries

Papers presented at the recent 22nd annual meeting of the Institute of the Aeronautical Sciences, at New York, are summarized here. The meeting set an IAS record for attendance, number of sessions and number of papers presented.

The digest printed below are the second installment of this year's papers. The first appeared in *Aerospace Week* Feb. 8, p. 41. Others will be carried in succeeding issues.

Aerelasticity

► **Theoretical Aspects of Properties of Low Aspect Ratio Aeroelasticity: Qualitative Right Answer to a Compressible Medium**—Conference with Other Theoretical and Several Applications to the Problems of Flows, Second Member, Dynamic Engineer, Lockheed Aircraft Corp.

Theoretical solution set forth in terms of isolated vortex solutions for the aerodynamic properties of rigid low aspect ratio bodies in oscillating airflows is a compressible medium for the complete range of reduced frequencies. Numerical coefficients are tabulated for use in predicting the response for lift and pitching and rolling moments for the rectangular and triangular plan forms. Comparison of lift and pitching moment (magnitude and phase) are made with wind-tunnel data for the rectangular and triangular wings oscillating in pitch about the root chord point.

The homocyclic oscillating methods are applied for predicting the flutter speed and frequency of several low aspect ratio

configurations. The experimental data on spans and frequencies were obtained from section models using a stress camera at the principal event of aerodynamicity.

► **Generalized Aerodynamic Forces on the Delta Wing with Supersonic Leading Edges**—J. W. Lee and S. R. Ghosh, Dynamic Unit, Buick, Dept. of the Navy, G. Zarnescu, Sr. Engineer, Aero-Rotor and Structures Inc., North, M. T. T. and M. M. Voss, Director, Dept. of Aeronautical Engineering, MIT.

It is shown, on a simplified basis, that the flow about a delta wing, with or without thin shear layer, can be treated as a problem of a doublet flow in a fluid of zero viscosity. It is also shown that this result is in good agreement with the exact results when the exact results are available.

The exact expressions are then obtained for determining the contribution of an air battery flexible mode to the generalized forces on a delta wing flexible mode, which can be represented by a double polynomial series. The exact results are the use of strip theory is found analytically, and comparison calculations are carried out for several cases of practical interest. It is seen that the strip theory result is sufficiently accurate for problems of interest in control.

► **Some Applications of Generalized Aerodynamic Forces to Control Systems on Airplane**—H. P. Lee and J. C. Hoshell, Langley Aeronautical Laboratory, NASA.

A review is first made of the various methods involved in the application of the techniques of generalized aerodynamic forces to the analysis of airplane behavior in rough air. Three aspects include the concept of control response, as well as calculating airplane response to gust disturbances, the



Movie Cameras Check Outlast Fighter

Designers and pilots are able to study cameras mounted on the Outlast fighter. Navy fighter looking and taking characteristics in various modes with the transonic setup used at the company's Delta plant. An F-4 Phantom II (41) equipped with 12-in. and 20-in. telescopic lenses with a 15-micron resolution of digital video a smaller CASP

(ignorable strong point) 16-mm camera (20 with 6-in. lens provides double coverage. A better guideline is used to track the camera. Picture angle, usually about 170-deg, was increased in 14-deg and 20-deg, to increase coverage, and also give the camera the same 16-in. resolution of single film frames for detail study.

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PRODUCTION BRIEFING

► **Central Engineering Corp.**, Wichita is now firm licensed by T. A. (Ted) Wells, former vice president and engineer of Beech Aircraft Corp., who has purchased the exclusive sales rights for Central Cells electronic welding products in the electronic bonding equipment market. Wells' new firm will handle all of applications engineering and testing required to adapt the welding devices to various types of lock kits, mobile heats and other bonding equipment.

► **Aircraft Engineering & Maintenance Co.**, Oakland, Calif., has received a contract in excess of \$2 million for re-equipment Lockheed T-33 jet trainers. It will provide equipment for 400 workers for approximately a year.

► **Boeing Airplane Co.**, employment at end of 1955 was more than \$7,500 at Seattle and over 25,000 at Wichita. The latter plant, which has been named a second source for the Boeing B-52 Stratofortnight bomber, has started a \$150 million tooling program. During the year Boeing added approximately 151,000 sq. ft. of floor space. The firm has also leased an additional 105,000 sq. ft. of floor space in two Navy-owned buildings on Flacker Island, Seattle, for B-52 requirements and wind shops. About 1,000 employees will be engaged here. A 20,000-sq. ft. tool plant across the street from the Seattle plant has been purchased for \$151,000 for use by the company's plastic shop. Approximately \$10,000 will be spent in remodeling this facility.

► **North American Aviation's** Buena Vista, Calif., Division has been given a \$2-million contract to remodel 21 runway USAF F-86 Sabre jet fighters.

► **Bendix Aviation Corp.**, North Hollywood, Calif., is building a new structure to permit expansion of its airborne and hydraulic engineering departments.

► **Aviation Division of Robertshaw-Fulton Controls Co.** has broken ground on a \$500,000 plant expansion in suburban Los Angeles. The division makes electronic, electro-mechanical, hydraulic and pneumatic components for aircraft, guided missiles and fire-control systems.

► **Harte Flying Service, Inc.**, and **Dorchester Flying Service** have consolidated facilities at Municipal Airport, Chanhassen, Minn., to expand service to business and other private aircraft. Both companies will continue their individual interests in Aerie Commuter and Aeromax divisions respectively.



Now available, for the first time, is a printed record of the AC defense-production story. All AC activities and resources are interestingly presented via picture and text. Through it you can become quickly acquainted with the physical facilities, manpower, training programs and production achievements of this Division of General Motors. Get your copy soon and discover how the "know-how" and experience AC has accumulated in the past can be projected into the future . . . perhaps in your behalf! AC is now producing—in volume—the complex, high-precision, electro-mechanical devices for the Armed Forces:

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The following contract awards of \$25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.

[illegible]

Recent vans of Stork Aero Corp's all-metal 225 two-pliers, which is making production at the builder's Millville, Cal., plant. The craft has been designed for commercial and military purposes. Power plant is a 225hp Lycoming with Hartzel constant-speed propeller. Note tip tanks. Top speed at sea level is given as 230 mph and maximum range is 1,500 mi. Gross weight is 1,954 lb. (span is 25 ft; 3 in).

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NIKE DRY-RUN FIRING RANGE consists of banks of analog computers designed by Bell Telephone Lab engineers to simulate the anti-aircraft missile's performance against different types of targets. Nike, a beam-rider missile developed for Army Ordnance by Bell Labs, Douglas Aircraft Co. and Western Electric Co., is currently being deployed for land or defense (Aviation Week Dec. 28, p. 51).

Lab Simulates Nike Missions

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► **New USAF Policy**—New Air Force policy calls for aircraft electrical generating systems to be purchased under a single system plan, permitting from one manufacturer instead of employing individual component specs and procurement. Move is intended to assure

better system integration and performance. McDonnell F-101 may be first airplane outfitted under new plan.

► **Silicon Transistors Assured**—Pulse says it has successfully produced experimental silicon junction transistors having an amplification factor (alpha) greater than 0.95 and an alpha cut-off frequency greater than 18 mc. by its new surface barrier technique (Aviation Week Jan. 4, p. 50), confirming

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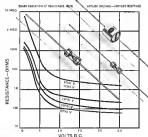
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merits in Canada are planes such as the C-103, F-86 or F-87. While flying the ball is far in speed and altitude are concerned, they are too small to simulate a bomber properly.

Larger aircraft, such as the North Star, have the run, but are deficient in speed and altitude performance. So the Chance is viewed as a happy compromise.

To date, RCAF has trained four complete Chance crews and has seven captains qualified on the aircraft. Selection is very rigid, only the cream of the crop receiving Chance instruction, Leigh says.

Turboprop Viscount Orders Climb to 88

Orders for Viking-Aerobus' turboprop-powered Viscount have increased to 88, boosted by contracts to deliver two of the transports to Finn Olsen Transport Ltd., Oslo, Norway.

This marks the first order for turboprop engines by a Scandinavian operator.

Other Viscount orders: British European Airways, 38; Air France, 12; Aer Lingus, 10; Trans-Atlantic Air Lines, six; Trans-Canada Air Lines, 15; British West Indian Airways, three; Hanning-Gale Air Transport, three; Inge Airways, three; Indian Air Force, two.

The 47 Viscounts sold they list to various operators are valued at nearly \$11 million, excluding spares.

Seventeen have been delivered to BEA, now operating 12 Viscount engines. Six have gone to Air France, using the turboprops on services from Paris to London, Milan, Geneva and Rome. Air Lingus' first Viscount is scheduled to begin its flight trials soon.

Lake Central Starts TCP Tests on DC-3s

First land service addition to its Skid Unit TCP (turboprop) airplane test program will be the Lake Central Airlines.

The carrier is currently conducting tests on the engines of two of its seven DC-3s. That will continue for about six months and will run through at least one engine overhaul period. Lake Central, Skid Unit and Pits & Wilkes Aircraft will carefully examine conditions of the propellers at time of test.

Meanwhile the airline is keeping track of each of all skid unit aircraft and systems of such type, comparing operation of the two test DC-3s with the five planes not using the addition.



DUTCH CRANE CRANE swings up North American B-25 to illustrate its lifting capacity.

Mobile Crane Can Hoist Big Planes

Nettlebush-produced crash crane with a hoisting capacity of 20,000 lb., is designed to pick up large aircraft bodies and move them quickly away from the scene of a wreck.

Abilities are not confined to moving planes. The crane-truck combination can also pick up such loads as complete "gunner" bays, prefabricated bridges, and water vehicles.

Portion of the crane's center mast is controlled by a hydraulic ram, may be positioned to accept loads of various dimensions. When set in use, it holds snugly against the trailer body of the vehicle, the boom extends almost parallel to the mast, extending forward. In this position, vehicle's total height is reduced to 9 ft. 5 in., permitting it to clear low underpasses. Maximum height with boom in the vertical position is 33 ft. Maximum length is 50 ft., and maximum width 19 ft. 4 in.

The switch is hydraulically driven, power being supplied by a 6-cylinder, 230 hp. GMC diesel engine. The powered, two-wheel unit mounts an engine delivering 195 hp at 1,800 rpm.

An unusual feature of the trailer is its variable level. Hydraulic jacks lower it just to the ground directly under the mast. After job is done, jacks are used to anchor the crane. When the rear wheels are lifted clear of the ground, they may be extended from their normal total of 9 ft. 10 in., to a maximum of 13 ft. 6 in., greatly reducing the crane's transverse stability.

Other specifications: turning radius—21 ft. 6 in. (only may be turned at 90 deg. to either side of the trailer allowing the vehicle to pivot about the mast); maximum lifting height—30 ft. 8 in.; loading speed—11 rpm; wheel base—21 ft. 6 in.; tire size—1800x24 and 2700x15; machine weight 20 tons and can make a speed of 25 mph.

The crane was built that the crane is being used by most European and several non-European countries and aviation companies.

Price of the crane, complete, is quoted at \$19,500. It is sold by Sole Power, West The Netherlands.

Results of the first two months of TCP operation are encouraging, according to the airline.

Control of the plane's braking system with the pilot and has enabled the carrier "to avoid any automatic go-around" on the brakes. The system is used to be lightweight and simple.

A voltage generator is attached to the side of each main wheel. One part of the generator is fixed to the side, the other, the rotating part, is mounted on the wheel. On the turn of wheels, current caused by a wheel sliding, and thus slowing down, the generator turns on the cockpit warning lights.

American airlines results to date have been good. The warning device has been shown to be effective in over 100 tests in the early part of the landing roll, when the plane is still light and the brakes, therefore, relatively ineffective. Now the end of the roll, when the plane is more, more heavily on its wheels, pilots tend to underbrake, or cut out the warning device.



Shore P-11 jet and refueling by EDO

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Shore P-11



EDC A-1
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Shore P-11
Shore P-11



Shore P-11
Shore P-11



Shore P-11
Shore P-11



Shore P-11
Shore P-11

OFF THE LINE

Automated Electronics, Inc., opened its new Radio Sales and Service Division at Raleigh-Durham (N. C.) Airport Feb. 15. The organization will direct installation of radio and associated equipment in all types of aircraft, particularly executive planes. From his old one 75075-ft hangar at the airport.

Gopher Aircraft Corp. has changed its name to Minnesota Aerospace, Inc. In addition, the company has added radio maintenance service to its existing aircraft maintenance, overhaul and sales activities. Address: World Chamberla Park, Minneapolis.

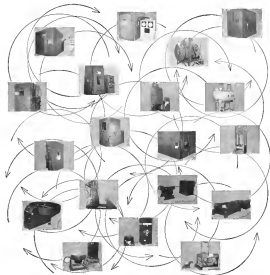
Three airlines are now using Test-Met message loading gear, according to the manufacturer, Test-Met Mfg. Co., Dallas. FAA's Pacific Alaska Division placed an order for the hp dual-line units. Previous users: Northwest Airlines and Trans World Airlines. Range: 1,000 ft., cost: \$4,100, 10 ft. Dallas.

Complete equipment for overhaul and test of PWAs jet engine fuel control system has been installed by Pacific Aerospace Corp., Burbank, Calif. With this equipment, PAC will be able to test complete engines, eliminating the necessity of shipping them back to the East Coast. The equipment, which is a complete overhaul, was loaned by PW-A and has been assigned to PAC's Burbank plant where it is housed in a special, explosion-proof room.

Large mobile heater for temporary hangar heating and engine preheating can deliver 1 to 4 million Btu/hr. It burns low-cost fuel, requires no flue. Blower can be driven by either electric or gas engine. Distributor has in cancelled prices that eliminate isolated hot spots. Unit requires no preheat before lighting, can be used in close quarters as close as 10 ft. Call: Eng-Dr. Foster, Inc., 1000 N. 1st St., Chula Vista, Calif. Eng-Dr. Foster, Inc., 1000 N. 1st St., Chula Vista, Calif.

Even as some models defined by Minnesota Chemical Co. for its low-pressure hydraulic fluid, Hydrolac has added up 25 million lb of air/air flying time in five years, has never been supplanted as an aircraft fuel, is used by 24 airlines throughout the world on over 500 airlines. It is available at 70 airports nationwide. U.S.

United Aircraft Products, Inc. has resumed production on several models of dual-type oil temperature regulators after a two-year lapse.



19 chambers of hell

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NEW AVIATION PRODUCTS



Lightweight Seats For 40-Passenger DC-3s

New passenger seats weighing only 7 lb each have been ordered by Philipps Air Lines to permit conversion of its 24 DC-3s to high-density 40-passenger "hot seats" operating on short routes.

The same number of conventional aircraft seats would average more than 1,000 lb, says the maker of the new seats, Borm Aero Seat Co., Inc. The seats may also be used for other applications "on it" or slightly "padded up" at little increase in weight.

As used in the DC-3, the seats are set in 80 rows, placing four passengers abreast with a minimum 15-in. aisle. Unstowed clearance is 34 in. They are certified for 50 or 90 loads in accordance with Civil Aeronautics Administration TSO C15. The manufacturer is offering them with folding legs and/or backs for passenger/cargo conversions.

Borm Aero Seat Co., Inc., 3900 Calhoun St., Burbank, Calif.

High-Altitude Fuel Pump Prevents Vapor Lock

A high-altitude pump that separates vapor from fuel at the supply tank as it feeds a solid line of fuel under pressure to either pistons or jet engines has been designed to meet MIL-P-5243 by Low-Ramco Division of Low, Inc. It also meets the qualifications of MIL-P-5235 and several aircraft manufacturers, states the firm.

The Low RR-1105B (CSAF Type B-188) pump delivers 6,000 lb of fuel per hour at 15 psi at from 90,000-ft altitude under such conditions of 7,500 fpm. Weight is 9 lb.

A single vanes shaft, driven by the main impeller and vapor separating impeller, runs on two ball bearings and allows the pump to operate without turning under dry truck conditions. To completely empty the tank, the pump has a second valve in a deep sump with the main impeller close to the latter. The second valve is removable.

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Twenty-First Annual

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ATTENDANCE FOR ABE FORMER Special Report on the latest developments in Military and Commercial Airline. This volume includes a listing of the significant European airlines, lists a wealth of information on using the Manufacturing and Operating phases of the Airlines.

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**—Keynote of AVIATION WEEK's
"Inventory of Airpower"**

traditional armaments of surface forces both on land and sea. The new Airpower Doctrine of U.S. Defense recognizes that true Airpower is composed not only of Military Aviation but also of Civil Aviation. Elements such as the Airlines, Business Flying Fleets and the Manufacturing and Overhaul facilities of Private Industry. This new Airpower Doctrine was developed by the Defense Department late in 1953 and was approved recently by the National Security Council and President Eisenhower. It will be the blueprint for the development of Military and Civil Aviation during the next three years. The 21st Annual Inventory of Airpower issue of AVIATION WEEK will be keyed by an analysis of the new Airpower Doctrine and its effects on all of the special phases of the Aircraft Industry by AVIATION WEEK's expert staff and documented by official fiscal figures and specification charts.

Inasmuch as the 21st Annual Inventory issue will be a record one in terms of industry usefulness, Military and Government reference, all companies Manufacturing for or serving the Aviation Industry are urged to be represented in this edition.

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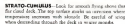
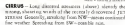
The Window Co., 9 Liberty St.
Newark, N. J.

Combination wrenches made by Snap-On Tools Corp. have single-lever operation on Banquet and that is partially provide extra gripping power for slightly undrilled or clawed nuts and on Parker-Kalon self-tapping screws with rounded corners. Available in 1/2, 3/4, 1 and 1 1/2 in. Snap-on Tools Corp., Kenosha, Wis.

Electronic controllers are designed for production testing, proof testing, system strength tests by extension under load method, stress cycling (load), stress (load deformation) cycling and speed cycling. Units available for use in any combination of testing controls—Tensile Olsen Testing Machine Co., 11855 Eastern Rd., Wixom, Mich., 48196.

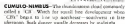
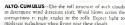
Shurtzpool spectacles, called Viro-Tec eye covers, reportedly give almost 100% protection from eye injuries. Over-eye protection is provided by built-in visor, while injury from side or bottom is prevented by "arm-cup" lenses, hand-lenses extending from lenses toward the cheek. Spectacles bought a little over 1 year—Waltham Optical Co., Inc., 253 W. Euclid Ave., Providence, R. I.

These weather items prepared in consultation with the United States Weather Bureau.



Just as it pays to know the weather, it pays to know the products that go into your plane. That's why it's smart to fly with famous Flying Red Horse aviation products. They have the approval of every major aircraft builder — surpassing the rigid specifications of the Army and Navy — have been the choice of every leading air carrier since the Wright Brothers.

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Get You There



as stress line facilities for using composite metal in deflected stress conditions.

Retention prepared by the Bureau of Aeronautics of transport with per engine of the 141 engine. Shipping containers are only about a 5100 weight in use of the most plus possible metal container over the standard packaging. Metal engine containers are less than 1400 to 5100 each. Weight less containers cost about 5100. If the metal container cost doubles that of the wood box which is rarely done for the large engine cost mounting weight will become a direct two cost item. These savings are possible even with the purchase of new metal containers for each engine produced. Actually, however, the metal containers are recycled after the Navy practice is filled in that the

quantity produced is approximately as cost factor for every 14 engine in service.

The Navy's marketing program has enabled the Bureau of Aeronautics to fast procurement of metal containers to a quantity per indication in most requirements. The system calls for the return of metal engine containers to engine contractors in GTF (procurement furnished property) when feasible.

By carefully separating of empty metal engine containers to provide the Naval Aviation Supply Office with an accurate and correct accounting, distribution is facilitated and accumulation of engine parts from the points of use are prevented. Information provided in the report, implementing other data available is also useful in determining requirements and return, and for

sales. A new area for the orderly return of containers to the engine manufacturer in GTF.

Quarterly assessments of engine demand to provide Navy are furnished the Naval Aviation Supply Office. The NAO submits to the Bureau of Aeronautics a quarterly report containing (1) an estimate of engine containers available for use, by stock number and application, after wind and field requirements and containers needed for open engines stored in warehouse have been subtracted; (2) estimated quantity of engine containers to become available at aircraft manufacturing plants in the next quarter, by stock number and application.

The NAO returns container report, to other with correct and engine production figures, are utilized by the Bureau's Product Control Division to determine which engine containers can be used for replacing in GTF to engine contractors. A shipping time factor of 5-15 days is used in these calculations. Based upon the above, suitable contract amendments for forwarding containers GTF are requested. These amendments include requirements for repair and parts engine and design modifications as applicable and is necessary by the engine contractor or his subcontractor, usually on an actual cost basis.

The Navy has a plan under way to exchange innovations of open metal engine containers with the Air Force. It is difficult to avoid accumulating some excess, particularly when it is due to discontinuation in the engine installation schedule at the engine plant, or when it is due to delay caused by delays or other circumstances events. Engines would continue to be shipped in metal containers to plants which had closed down ahead the time when they got back into production, a small price to pay for protection involved for engine costing \$100,000 or more apiece.

From all of the above, it is apparent that the Bureau of Aeronautics has one of the finest maintenance programs for aircraft on going in the service, and that substantial money, time and labor will continue to be used by the Navy's metal container program.

F. M. LARSEN, Lt. Colonel
U. S. Navy

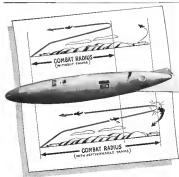
Praise

PLAN REPAIRS/REPAIRS IN SPAN REPORTS OF SERVICE FROM BEING ISSUED AFTER RECEIVED IN CONDUCTED AIRCRAFT WORK (JAN. 11, p. 62) AND OFFERED FROM A 10,000-WEIGHT OF AIRCRAFT (JAN. 8, p. 95) AS GIVEN BY VARIOUS COMPANIES. PLEASE WRITE OFFICIALS: BUREAU.

WILLIAM B. BROWDER
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Just read you page on the cooling system which Stratos built for the N3 airplane. All have are very pleased with your treatment of the subject and with clarity of presentation.

E. E. HENDEL, Feb. 24, 1954,
Stanton Division
Fairchild Engine & Airplane Corp.
Berkeley, L. I., N. Y.



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Oddly enough, the metal fabricating process first used to produce aircraft engine components helped put the "bite" into World War II bombers. The key power blades in the turbo-superchargers of high-flying B-17s and B-29s that provided extra speed and longer range were precision cast from high-temperature alloys by the unique Microcast Process.

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The Microcast Process offers exceptional capabilities in the mass production of parts and components. Product improvement through the use of better alloys, economies through the elimination of expensive machining operations, and greater freedom of part design are only a few of its advantages. Investigate Microcast today... it may well be the means of a better product at lower cost for you.

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WHO'S WHERE

(Continued from page 11)

William A. Frey is vice general sales manager for National Audio. Also promoted, Robert Rosenblatt, New York district sales manager, James Hunt, regional sales and service manager.

Ben Stuber has become general sales manager for Radio Cassette Audio Corp. D. W. Goss has been appointed general sales manager for Sylvaan Electric Products, New York.

Robert T. Flanagan has been promoted to agency and industrial sales manager for General Acoustics.

Edward Hoshik has been named sales manager for Tim Andrews World Service. Norman F. Springer has joined FALCO, Inc.

Ray Woodhull is a new manager of accounts and procedures for Philippine Air Lines.

D. A. Potter has been named manager of aircraft and military products for Sonnet Whinger Corp., Chicago.

Kenneth H. Flinn has been appointed purchasing agent at Viceroy Corp., Maywood, Ill.

Charles L. Boland is a new director of domestic sales for Southern California Aircraft Corp., Oxnard, Calif.

Howard W. O'Brien has been promoted to sales manager for Melmark Audio.

James B. Peters, Jr., has become chief engineer at Varco Aircraft Corp.'s Cassinville, Tex. plant.

W. A. Labadie has been appointed general regional manager in Washington, D.C., for Sonnet Whinger Corp.'s military radio line department.

Walter H. Reed is manager of Houston's new aviation department.

Frank E. Toren has been named sales representative for Fox Acoustics World Service, Los Angeles Division.

F. S. Tien has joined Priblud Aviation Corp., Los Angeles, as purchasing director.

Ray Charles has been promoted to manager of military sales for Minneapolis-Bloomfield, Regulator Co.'s Acoustical Division, Minneapolis.

Adam B. Gelbois is a new engineering manager of Condor Aircraft Corp.'s Test Division. Other promotions: James S. Nathan, manager of maintenance; M. Shaw Flinn, planning manager; Robert J. French, manager of design.

Robert F. Beall has been appointed contract administrator for Brown Line Corp., Beverly Hills, Calif.

Howard E. West has become assistant director of advertising for Northwest Giant Airlines.

James Seal has been promoted to system subcontract manager for Philippine Air Lines, according to Edward G. Shanon, who has resigned branch of GJ Inc.

R. A. Finner has been promoted to assistant of manager for Flying Tiger Line, according to Edward Hoshik, who has been transferred to a general assignment on the East Coast. Other changes: J. J. Brady, eastern regional manager; R. E. Kephart, southeastern regional manager.



The way we change angles on 'Copter Blades puts a brand new slant on controlling power

Out of these days, when you hop from leave to the office in your personal helicopter, you'll marvel at the way you "dial" gain... from "straight up" to "full speed ahead"... from "downwind" to "upwind". It will be done fast, smoothly, accurately.

Today, helicopter builders are using Cleveland Pneumatic's finest—a less controversial, a more and more built to adjust the angle of the rotating blades on the "copter. This device is called a "full-screw actuator".

Full-screw actuators are used in many applications in order of two ways... to

multiply the power of a drive... or to increase its speed. You also get the built-in flexibility of a mod-in-hand drive that eliminates nearly-obsolete positioning of other systems.

Somewhere in your product at your side for a product, you may be able to use Cleveland Pneumatic full-screw actuator. They've been engineered by us in all sizes... from tiny units for "copter blades on the ground that we use to raise and lower landing gear.

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AIR TRANSPORT

Court Ruling Seen as Threat to Flag Routes

- International lines adopt 'wait and see' attitude.
- But subsidy decision may force reorganization.

By Frank Shea, Jr.

A policy of "wait-and-see" has been adopted by airlines affected by the Supreme Court ruling that carrier profits across domestic operations must be offset against international subsidy requirements (Airspace News Feb. 8, p. 11).

Most U.S. 5-day airlines believe it is too early to estimate the full impact upon individual carriers. Those concerned—Braniff Airways, Delta-CGS Air Lines, Northwest Orient Airlines, Pan American, World Airways and Trans World Airlines—are standing pat awaiting further clarification of the court's ruling.

• **Through studies by airline attorneys** • **Cost Accounting Board** evaluation and interpretation and announcement of overall Board policy in applying the law.

But one thing seems certain. In looking at basic CAB subsidy policy, the court has shaken the very roots of the airline industry.

Since as it is an indication of further scheme legislation to come, and general feeling is that a complete reorganization and shakeup of the international airline route structure is inevitable.

• **FAA May Ban**—The American aviation is the only carrier in the group that is strictly non-flag. The decision, if anything, it should stand to benefit, because FAA is an international airline with no domestic operations whatsoever.

Up to now, as with airlines operating combined domestic-international services, CAB has treated Pan American's various divisions—Atlantic, Latin American and Pacific Airways—in separate rate-making units in determining subsidy requirements.

CAB has across earnings in FAA's domestic Latin American Division, for example, to offset subsidies that other carriers would have been provided in other divisions.

With respect to Pan American, the Board consistently has held that "need" of this carrier for subsidy enhanced its status relative to other carriers.

Offset Decision

The Supreme Court's offset decision affects first of the 15 domestic routes, Delta-CGS, Delta-CGS, Northwest and TWA. All are engaged in both domestic and international operations, however, classified by Civil Aeronautics Board in separate units for rate-making purposes.

Delta operates a route from U.S. to Brazil and Ecuador Arm via Havana, LaHua and the west coast of South America. Delta-CGS flies

through the Caribbean area to Venezuela and San Juan. Northwest flies to the Central and Alaska-Tokyo, while TWA operates a trans-Atlantic route from New York to India via London, Paris, Rome, Cairo and the Middle East.

American, Eastern, United, National and Continental also have flag operations, but these generally are regarded as "subsidy" operations sufficiently integrated with domestic operations.

geographical divisions. This definitely differs from CAB's stand in the Supreme Court case, but the Board holds that the question of whether domestic and international operations should be treated separately is a completely different problem.

• **Looking in Longlines**—Most drastic consequence of the court decision would be the necessity of dropping international routes by all combined domestic-international airlines. This would leave Pan American as the only international U.S. flag carrier.

All companies affected—Braniff, Delta-CGS, Northwest and TWA—admittedly are worried. But they agree to make any comment until they have had an opportunity to study the problem thoroughly.

Attempts are being looking for longlines, and such a change to see what course of action CAB will follow before making any move.

As Transport Assn. also declined official comment at this time. A spokesman says, however, that the possibility of carriers forming separate sub-units for international operations is being explored. There would be similar in the non-flag carrier American Overseas Airlines, subsidiary of American Airlines.

• **Possible Effect**—In the absence of any official release statement, CAB's apparent belief the Supreme Court gives good indication of possible effects of the decision.

CAB says international operations presently require subsidy support. Despite question of the combination airlines now do not require such support. The Board points out, and the carriers are paid domestically under class-rate and inter-rate that also are applicable to other lines operating only in the U.S. Because of differing factors affecting

domestic and international operations CAB holds that it is extremely difficult to fix a system rate for carriers comprised of both divisions, or to fix first rates for both divisions simultaneously.

• **Maximum Efficiency**—The Board can trade that maximum operating efficiency on the part of airlines, and the development of an transportation, are provided by placing and retaining an eye on first-rate rates, under which they either may be benefited or stand the losses from future operations.

CAB adds that where there are class-rate rates, as is now the case with domestic operations, additional benefits are obtained in that airlines are forced to compete domestically with other carriers of their class in securing revenue and in reducing or controlling

• **Final Rate Decision**—Under these circumstances, says CAB, "the Board believes that the air transportation system will be benefited by the fixing of final rates, domestic divisions, and the rates of the international ones, either by retaining the rates as carrier rates on a temporary, as a carrier basis during the interim period required for fixing of a final rate, or for carriers during living of domestic rates."

"Moreover, even if the inter-rate carrier system are used as the rate system units present domestic earnings will not require international operations, and it may be expected that the carriers will simply become subsidized on a system rather than in a division basis."

"This result will carry no long-range operating benefits, and will usually serve to destroy the benefits which presently flow from the Board's classification and rate-making policies. In addition, domestic earnings will no longer be available for use in providing improved

domestic operations and for reducing domestic rates."

Discretionary System—Testing the entire air carrier system as the rate-making unit also will be discretionary between carriers, contends CAB. The Board says airlines engaged in only domestic operations will be permitted to adjust their profits, whereas those engaged in both types of operations will be required to use domestic profits for support of losing international operations.

CAB wants that, under these circumstances, they gradually will attempt to withdraw from international operations and the Board may find it necessary to authorize withdrawal since a reluctant operator hardly can be expected to serve the best interests of the U. S. in the international field.

The Board holds the position that:

- Carriers operating both domestically and internationally can operate both types of service more economically than can solely separate airlines.

- Subsidization of entirely new carriers for the present need would not result in any savings to the government.

- Public interest would not be served by the alternatives of permitting a single U. S. international carrier to operate all overseas service, or the cancellation of surface carriers for foreign air transportation.

Reversed Controls Cause of WAl Crash

Forward substitution of antenna control cables and pulleys during overhaul was responsible for crash of a Western Air Lines Douglas DC-3 shortly after takeoff from Los Angeles International Airport June 29, 1953. Civil Aeronautics Board investigation report.

The plane was on a routine test flight after overhaul and carried only two persons. The pilot and co-pilot were injured and the aircraft, spinning, sitting in the pump out, was killed.

Soon after the plane became airborne the right wing dropped and struck the ground, according to CAB's official report on the accident. The DC-3S then cartwheeled and came to rest inverted. It sustained major damage.

The investigation brought to light that the reversed assembly was caused by the mechanic's misinterpretation of a diagram in the overhaul manual.

Had the airline's maintenance procedures been more explicit, investigation says. "It is unlikely that the assembly mistake would have been made."

Four days after the accident WAl, specified that checks be made by maintenance, inspection and flight crew not only at line and full control travel but direction of the control surface relative to movement of control controls.

AA Opens Fight for Mexico Route

Airline answers PAA, Eastern objections to nonstop service as legislators carry case to Senate floor.

American Airlines, failing to return its proposed nonstop New York-Mexico City route, last week was scheduled to present its case at a hearing in the District Court of Appeals in Washington, D. C.

Now AA developments since a court stay order delayed consideration of the service (AVIATION WEEK Feb. 8, p. 87).

American filed its suit in Eastern Air Lines and Pan American World Airways petition to stop the new route.

Sen. Russell B. Long attacked in the Senate as "subject to across criticism" Civil Aeronautics Board's 40-minute, "cloud-clear" approval of AA's nonstop Mexican service.

Long and he is going to request the President with the American controversy because it points up "intervention between nations" and "discrimination between carriers." In the latter, he referred to failure in the past to get "proper air service" between Louisiana and Mexico.

Sen. Alexander Wiley, chairman of the Senate Foreign Relations Committee, praised CAB's swift action "to protect the U. S. national interest . . . for which they deserve the commendation of this body."

American's Charge—The court stay passed from Feb. 8 until Feb. 13 is hearing on the matter after American filed its opposition statement. The same charges.

Eastern and Pan American devoted

traffic would involve 2/10 of 1% and 14/100 of 1% of the total revenues of each respectively.

If American's nonstop route between New York and Mexico City will divert traffic from the existing routes, as will the newly inaugurated Air France nonstop flights over the same route (AVIATION WEEK Jan. 25, p. 7).

When the proceeding was pending before CAB on Air France's permit to fly New York-Mexico City, Pan American did not intervene and EAL filed its opposition after public hearings had been concluded.

PAA and Eastern's assertions that American's new route would do irreparable injury to the existing lines' service is not enough to warrant a stay, petitioners must "show" damage to "their legal, substantial and irreparable."

Business of a day means the only United States carrier operating between New York and Mexico City would remain powerless to meet a foreign airline's (Air France) nonstop competition from a CAB's emergency order, which would permit AA to begin nonstop service to Mexico City, it happened.

A stay will "greatly complicate" and perhaps "irretrievably frustrate" American's negotiation with Mexico, now in progress under State Department approval.

Eastern's argument that Presidential approval is necessary for such an exemption to the exclusive requirements of the Civil Aeronautics Act is belated.



United's First DC-7 Gets Its Wings

Fuselage of first Douglas DC-7 for United Air Lines is mated to the wing at Santa Monica, Calif. UAL has 25 of the Wright

Turbo-Compound powered version on order. A 61 jet on first DC-7 the spring. UAL will carry 16 passengers, 14,400 lb. of cargo.



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because "it flies squarely in the face of long-established practice by the Board." American's chief contention. It is the only U.S. airline providing service between New York and Mexico City (via Dallas/Ft. Worth) and must be permitted to begin nonstop service to compete successfully with Air France.

► **Fifth Freedom.** Air France began operating nonstop between New York and Mexico City Jan. 19 under a Fifth Freedom traffic agreement signed in December 1961.

American intervened in the 1951 hearing, claiming the U.S. should not give the French airline such permission until the government had taken the steps necessary to assure that the competing U.S. carrier, American Airlines, would be in a position of competitive equality.

At that time, AA also asked the Board for an exemption to compete with Air France. The latter action received approval and no action was taken on American's request.

"It is a fair assumption," AA says, "that this government's original grant of Fifth Freedom rights to Air France was made with the thought that in the time they could be obtained, a route pattern would have been established with Mexico which would place United States flag air transportation in a less competitive position."

PAA and Eastern are affected by the latest controversy because both make a connection at Houston, Tex., for New York-Mexico City business. PAA American flies between Houston and Mexico City with Boeing 747s. Then, an optional intermediate stop, EAL operates New York-Boston-Buenaville.

► **\$14.5-Million Revenue.** William D. Stewart, Jr., director of economic provisions for American Airlines, is an official of the court that the air line carries 82.5% of the total passenger air traffic between New York and Mexico City as based on the Board's traffic survey for March and September 1952, the last available.

Stewart says AA business on the route amounted to \$5,955,000. He claims Eastern stands to lose \$322,600, 2.1% of 1% of its other passenger revenue. All of its passenger traffic between New York and Mexico City, via Houston at Buena Vista, was diverted to American's nonstop service.

Pan American's total traffic in the new zone in 1971 would have been about \$195,000, or 14.1% of 1% of its passenger revenue, Stewart says.

Citing several examples of CAB's exposure to personal criticism to affect their work, American points out that PAA received an exemption Jan. 20 in order to serve Westover Field, Mass., and Bournemouth, England, as intermediate stops on regularly scheduled trans-Atlantic cargo flights.

BOAC Makes 50 Changes in Comet 1s

(McClure 128 World News)

London-British Overseas Airways Corp. is making nearly 50 modifications to its greatest fleet of the Hawker-Siddeley Comet 1s, but few of the changes appear to be based on the crash of a jet transport last month off Elba (Aviation Week Feb. 1, p. 16).

An **Excess of Fuel** Accounting as Transport (EAT) are following suit. Many of the modifications, expected to be completed by the end of this month, were divided upon before the BOAC crash. Most will be incorporated in the design of the Comet 2 and 3 Comets.

► **Unusual Heat.** One of the modifications of the Comet accident, BOAC chairman Sir Miles Thomas says. "To date, nothing has been found that might possibly be accepted as prima facie cause of the accident."

"There are signs from early salvaged parts of unusual heat near a fuel tank,"

► **Control Protection.** Many of the proposed modifications are contained in and around the engine bay, designed to give greater protection against and more warning of fire. No changes are proposed for the controls in the control cabin. De Havilland, BOAC and the British Air Registration Board do not believe an introduction of pilot error in the Comet's fully power-operated controls is necessary.

Among the more important modifications:

► **Avionics plate shields.** Between wing fuel tanks and the tailboom Sir Miles emphasizes that there is no recorded case of a DHI Gnat engine fire. The CAB permits one that engine may or may not change for government use of facilities, even when used in substantial Mass communities previously operating non-stop airports do not change because they are deemed direct and to direct benefits in terms of maintenance and associated business.

► **Special ventilation** to the outside for the Comet's engine nacelles, based on equipment by Lockheed under the patent.

► **Special metal bonded housing** is being introduced into fuel lines in the area of fuel control chamber chambers. Engine as quantities as are to be increased from the present 75 hour periods.

► **Extra smoke detector** is being installed in the rear fuselage and an additional lightning conductor on the fin.

► **Warning** to the crew about supplies in the advance bomber bay is being based on a conduit.

Other changes extra temperature gauge in equipment bay, improved ventilation of rear fuselage under floor mount, removing roller landing edge

steps, installation of legged steps on hoisting pump controls.

Sir Miles hopes to have these jobs done by the end of February. He plans first at that time for all apply to the Minister of Transport for private use to contact South Africa services.

BOAC is losing \$750,000 a week in revenue with the Comet 1s grounded.

CAA Sets Federal Use Rules for Airports

Civil Aeronautics Administration has established a set of rules for determining "substantial use" of municipal airports by private owners and operated by the federal government.

Based on studies for regional administration, they specify that substantial use of an airport by the government is considered to exist during any calendar month when:

► **Five or more federal aircraft** are based regularly at the airport or as adjacent property.

► **Total number of movements** (landings and takeoffs) in a month is 500 or more.

► **Costs** cumulative weight of government aircraft using the airport (total movements multiplied by gross estimated weight of the aircraft) is in excess of 5 million lb.

CAA says federal use could be substantial without meeting any of these conditions and that such cases will be determined individually.

In all cases, the CAA regional administration will take action only upon request from the owner after he has negotiated with the agency using the airport. Letters or agreements with the government may be entered into.

CAA permits use that airport may or may not change for government use of facilities, even when used in substantial Mass communities previously operating non-stop airports do not change because they are deemed direct and to direct benefits in terms of maintenance and associated business.

LAS Work Volume Increases 40%

Lockheed Aircraft Service International at New York's Idlewild Airport reports a business volume increasing 567,745 man-hours in 1971, a 40% jump over the previous high—512,897 in 1952.

Total number of deliveries was 961, a 15.5% increase. Commercial aircraft accounted for 576 deliveries and a total of 543,645 man-hours with 1,918 devoted to commercial helicopters.

Military planes accounted for 12 deliveries and 217,555 man-hours, while 17 deliveries were made in executive aircraft for a total of 5,255 man-hours.

and Miami at just more than 3000 seats per tri-week.

Chicago and Jacksonville, Tampa and Miami at just more than 3000 seats per tri-week.

Chauvin predicts the Post Office parcel has good chance of being approved by CAB because of success of the original plan. Inquiries: Western Div. 11, p. 26; under which American, United, Capital and Trans World Airlines are flying a percentage of service mail.

U. S. Skeds' Airlift Capacity Gains 42%

Airt capacity of U. S. domestic and international scheduled air services grew 42% in three years while operating aircraft increased only 17%. Civil Aeronautics Administration reports.

A pack of 1,136 aircraft were in operation in June 1955 compared with 1,142 in mid-1952. However, their plants, mostly of larger and later types, can carry a billion tons more a year over the 1950 fleet.

Skeds: Ten Miles-Airline's greater percentage of available ton-miles was used in 1955 than in 1950. Domestic trunk airlines had 1,594 million ton-miles available in 1950 and filed 249 ton-miles in 1953, with 2,629 ton-miles avail-

able revenue ton-miles increased to 1,542 million ton-miles.

Pattern has been the same for local service, all-cargo and international scheduled air carriers.

Fleet Deliveries-Fleet changes in 1955 included four transport models that were not in service in 1950: Convair 440, carrying 40 passengers; Douglas DC-8B, seating more than 60; Lockheed 1049, flying more than 70; and the Martin 4-04, which carries more than 40.

Deliveries at the Garrett, Lockheed and DC-8B and the Douglas DC-7 will continue during fiscal 1954.

The number of carriers in local service, metropolitan and international operations has dropped from 25 to 18 during the last three years, with the number of aircraft flying down 175 to 199. Combined all-cargo carriers had 74 planes in 1955 compared with 31 in 1950.

Examiner Approves Samoa Air Service

Samoa Airlines-backed by a Honolulu multi-millionaire-has won their civil recommendations from a Civil Aeronautics Board examiner to begin operating flying boat service between the American and British Samoa Islands.

The recommendation classifies a month-two-year fight by the proposed airline for a CAB certificate to fly 74-passenger B-74s from Pago Pago, capital of the U. S. possession, to Apia in the British Islands.

\$450,000 Backing-Major factor in the examiner's approval was \$150,000 in financial assistance from George W. Murphy, Honolulu's business executive who testified at Board hearings that his assets total \$67 million.

The backing-plus withdrawal of Sa Samoa president Lawrence M. Coleman's request for federal subsidies to closely operating boats-would justify issuing the certificate, the examiner reports.

The CAB official describes the air line as "an experimental operation which will test the feasibility and economic prospects" of air service between the islands.

Passenger-Cargo-Under the proposed five-year temporary certificate, Samoa Airlines would operate four scheduled round trip flights weekly between the two cities, plus charter service within a radius of 1,700 mi. to other Pacific Islands. The flights would carry passengers and cargo but would not handle mail.

Murphy says he hopes the airline will expand eventually to provide a

link from Hawaii to Samoa, Tahiti and other South Pacific islands.

The Samoa Airlines now are served only by boat and seaplane flights.

CAB ORDERS

(Jan. 27-Feb. 5)

EXEMPTED

Trans-Texas Airways from providing air service between Brownwood and Coleman, Tex., authorizing the airline to serve routes in Oklahoma on flights to occur at one meeting per day and to east service to Brownwood on flights serving Coleman.

Trans-Texas also is exempted from conducting direct flights between San Angelo and Kermit, Tex., and authorized suspension of service at Del Rio, Eagle Pass and Uvalde, Tex., provided the carrier does not conduct direct air service between Ft. Stockton and San Antonio.

ORDERED

Albuquerque Airlines, Kansas Air Lines, Central Airlines, Frontier Airlines, Lake Central Airlines, Mohawk Airlines, North Central Airlines, Quik Air Lines, Piedmont Airlines, Pioneer Air Lines, Southern Airways, Southwest Airlines, Trans-Texas Airways and West Coast Airlines to show cause why Board should not set new mail rates for them.

Investigation of dry dock loss at Richmond Airfield from Jacksonville, St. Petersburg and Tampa, Fla., to Washington, D. C., and suspension of that air delayed in May 5.

GRANTED

Part of New York Authority leave to determine in the South Atlantic coastal area.

County of Hawaii, T. H., county of Maui, T. H., and city and county of Honolulu leave to determine in the South Pacific coastal area.

Apia Air Lines Co. permission to use Tokyo Hirota Airfield, Wake Island Airfield, Honolulu International Airport, San Francisco International and Kadena Airport at Naha, Okinawa.

DENIED

Exception to Transamerica Air Lines to fly between Cincinnati and Cincinnati by American Airlines flights, and their baggage from Newark to New York.

DISMISSED

Application of Fred B. Williams and Douglas Air Express for approval of interlocking relationships with latter State Express, of which Williams is president.

AUTHORIZED

Mohawk Airlines to operate the retail schedule point of Miami, N. Y., on one daily flight from Washington to Rochester, on going May 1.

APPROVED

Intercompany agreements between Trans World Airlines and New York Airways and related office air service.

SEARCHLIGHT SECTION

(A special section)

EMPLOYMENT OPPORTUNITIES

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Airports & Real Estate

I have just seen your most interesting editorial of Jan. 4 entitled "Municipal Airports vs. Property Values." I believe the report would be most stimulating to some of the newspaper readers in our second Member's N.Y. Two persons there is requested for reprinting the editorial and one forwarding it to a printed list of newspapers.

W. CLARKE, President
Massachusetts Area Chapter of Commerce
19 South St.
Boston, N.Y.

In your editorial page of the Jan. 4 issue, you have written an article entitled "Municipal Airports vs. Property Values" whose reference is made to a report titled "The Impact of Municipal Airports on the Market Value of Real Estate in the Adjacent Areas," by William G. Wulfsberg.

The findings you mention are of great interest to me, and I would very much like to obtain a copy.

WILLIAM G. BATTENBERG, Esq.
McDonnell Aircraft Corp.
Post Office Box 518
St. Louis 3, Mo.

[To Mr. Wulfsberg, and others who have asked for copies of this survey, we suggest writing Mr. Wulfsberg at 31 W. Jackson, Chicago, Ill. 60604.]

Chamberlin & Boats

I get a big kick out of your writing on the new Chamberling Boat ("RTS Flyer" Sports News September 6, Jan. 25, p. 22). I've been searching that sort of thing since I met someone when, with little results. You ran a group of us tried to get CAA to sponsor a parallel service with boats as companion with an existing helicopter line to keep the flying hot while developing marine use, with no results.

My friends have finally convinced that a flying boat could be built with lights and faster than an airplane. He began carrying the same problem. Besides being for the passengers, it would be far less expensive to people on the ground, not to mention the safety factor.

A few of the Wilson spent on long runs would have eliminated their need, it spent on producing the boat or replace. To me one of thinking, however, because he said as they become larger, whether boats become only as they become larger. There have been plenty of boats built and plenty of them were experimental, largely because of the lack of really good engines. With today's power and new hull designs you can literally fly them out of the water rather than "bouncing" them out with little more help than light wing loading.

In the past the problem of taking off landed is considered an other danger problem that speed become secondary, with the result that the lightweight get a tremendous head start. Eventually is warranted to carry the bulk of the traffic, to save playing an overreacting role in mili-

tary force has suspended boat, relating this to a truly good flying airplane that I intend to our boat when I'm put in an old-fashioned Connecticut and ready to take sailing country property to keep active. I can't say that I like a better than aviation but it is worth it not to have to live under a lot of half-baked regulations.

On the other hand, it is not it were to be able to think your sort of three and noddle them from the wisdom in the hope that some relaxation of their lenient attitude toward pilots flying over water.

They have destroyed the nature of pilots in flying. Next, the Air Force will have to do it with their student pilots. If there is one thing there is all efforts that goes toward making a pool pilot is a genuine desire to fly.

CLARENCE D. CHAMBERLIN
Kaplan Inc.
Shelton, Conn.

One good reason I love water flying is that I've spent most of my life downing moose and moose in order to get in and out of tight spots. My first field is a lake 100 ft wide and 600 ft long in front of the first 70th street in Detroit, Mich.

As a sample of the "how storming," I spent 2,111 pennies in one day with one Copter Company. Under at the old Wrentham Air Airport in Detroit, Mich., directly across the street from the De Soto Hotel. The field was 1,200 ft wide and 1,800 ft long. Due to the wind, I had to land the short way over the De Soto and 10 ft light wave and step in 1,200 ft, for one light wave, using street lights and windmills of sight.

After five years of that sort of flying I'd write for Long Island Sound with 100 miles to take all well land. But a sample to be in that it's open water, coupled with enough distance for back in it is impossible to get the full down and bailout of scale after one touching down.

Water gets you on the move, with more time for a designer to see his ideas than in any other mode of flight. He begins to design his airplane through their regular boat. He will probably have to speed half the time to get the CAA to give the CAA order to permit them to use running the air plane. If they can't permit the production of the plane they still have the opportunity of raising the problem and making an airplane that few will want to put up with it in order to do as they have done in the points flying field.

I have been flying flying experience, covering over 20,000 hours in the air, have earned over a million passengers without a scratch, appeared on one scheduled airline with 100 of my own flying. I was a member of the Baker Board that revised the method of passing safety aircraft—taking away out of the design. Success, smiling in the equalization of the late 100-100 of which gave a rough idea of what constitutes a safe flying airplane.

I got as far up with the time, money and

effort required to back the CAA in order to make a truly good flying airplane that I intend to our boat when I'm put in an old-fashioned Connecticut and ready to take sailing country property to keep active. I can't say that I like a better than aviation but it is worth it not to have to live under a lot of half-baked regulations.

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CLARENCE D. CHAMBERLIN
Kaplan Inc.
Shelton, Conn.

Procurement Data

We have received with great interest the title titled "Aircraft Procurement: CMAA's Expenditures by Month, 1950-54," published on page 17 of your Nov. 9 issue. . . . You are to be congratulated on this as well as another address in just some which do much to further the probable aim of all members of the aircraft industry in this area and production schedules the loss of actual information rather than sup positions.

G. H. WHEATON, Sales Planning Group
Aircraft Manufacturers Co.
Los Angeles 41, Calif.

Side-by-Siders

Many thanks for your issue of Dec. 2 getting. I am permitted to report the side-by-side article from your Nov. 10 issue.

You may have been aware that engine exhaust pollutants caused a completely anonymous article that Ryan had been dropped from the competition and for this reason we merely needed the reports from the excellent Avionics News piece to fill out that unfortunate report.

WILLIAM WHEATON, Public Relations Manager
Ryan Aircraft Co.
San Diego 12, Calif.

Praise

Your publication is a most valuable source of information, which has been of material assistance to us in conducting our experiments. I wish to commend you on the scope and completeness of the material you have published in Avionics News. S. A. PARR, Esq., Vice President
The Tremble Engineering Co.
2018 Cottage Ave.
Cleveland 13, Ohio

[Editor: Editor again on page 76. Editor Robert H. Wood is an air of West Coast aircraft pilot. The editorial will appear here shortly.]



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